Trinity Site
White Sands Missile Range
Vicinity of WSMR Routes 13 and 20
Socorro County
New Mexico

HAER No. NM-1A

PHOTOGRAPHS

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
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HISTORIC AMERICAN ENGINEERING RECORD

TRINITY SITE

HAER No. NM-1A

Location:	Trinity Site White Sands Missile Range Socorro County, New Mexico UTM: 13.363200.3727100 (Ground Zero location) Quad: Mockingbird Gap
Date of Construction:	December 1944 - July 1945 for all buildings erected by military; ranch properties date from ca. early twentieth century.
Present Owner and Occupant:	U.S. Army
Present Use:	Part of rocket and missile testing range
Significance:	The United States detonated the world's first atomic bomb at Trinity Site on July 16, 1945. The site contains a fenced-in area and marker at Ground Zero, the remnants of a number of test structures, the remains of Base Camp, and the restored George McDonald ranch house where the bomb's plutonium core was assembled. Trinity Site was listed on the National Register of Historic Places, and designated a National Historic Landmark, in 1972.
Historian:	William A. Brenner, AIA, November 1985

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BACKGROUND: THE MANHATTAN PROJECT

The United States detonated the world's first atomic bomb at Trinity Site in the southern New Mexico desert at 5:29:45 A.M. mountain time on July 16, 1945. The detonation was the key test of a top secret effort, code named the Manhattan Project, to build and deploy atomic weapons in time to affect the outcome of World War II. Carried out by the Army under the direction of General Leslie R. Groves, it was the largest and boldest combined scientific and industrial effort ever attempted.[1]

The project was conceived in 1939 when Albert Einstein wrote to President Franklin Roosevelt of the need to develop nuclear weapons before the Germans, who were known to have begun research on an atomic bomb. The atom had been split for the first time in a Berlin laboratory in 1938, and the principle of nuclear fission was generally understood by the world's scientific community. Prewar atomic research was limited in the United States, but in December 1942 under the auspices of the Manhattan Project, Enrico Fermi and his colleagues at the University of Chicago's Metallurgical Laboratory produced the world's first sustained nuclear reaction.

While the construction of an atomic bomb was considered scientifically feasible, the technology for producing fissionable material on anything greater than a laboratory scale was unknown, and methods for using the material to make a bomb were largely unexplored by American scientists. Two fissionable materials for the bomb were considered: uranium-235 and plutonium-239. Scientists at the University of California at Berkeley, at Columbia University, and at a specially formed secret organization in New York called Kellex carried out research on separating the isotope U-235 from the naturally occurring element U-238. Concurrently, the University of Chicago conducted research on plutonium.

In 1943 and 1944, a huge facility for the separation of U-235 was constructed at Oak Ridge, Tennessee. It had two sites, one for separation by the electromagnetic process, and one for separation by gaseous (and later thermal) diffusion. The Oak Ridge facility covered 54,000 acres and, at its peak in May 1945, employed 82,000 people. Concurrently, another giant industrial complex was built at Hanford, Washington, for plutonium production. It occupied a 600 square mile site and employed over 45,000 people.

Major industrial and engineering firms involved in building and operating the electromagnetic separation plant at Oak Ridge were Allis-Chalmers, General Electric, Stone and Webster, Tennessee Eastman, and Westinghouse. Those involved in the gaseous and thermal diffusion processes were Allis-Chalmers, Houdaille-Hershey, Chrysler Corporation, Kellex, Union Carbide, H. K. Ferguson, and J. A. Jones Construction. The Dupont Corporation built and managed the Hanford Plutonium plant.

Meanwhile, a secret scientific laboratory under the direction of J. Robert Oppenheimer was established at Los Alamos, New Mexico, to design and assemble the actual uranium- and plutonium-based atomic weapons. The laboratory site was selected in late 1942 and the first contingent of scientists arrived in March 1943. By June, 250 scientific personnel were at work on the physical, chemical, and metallurgical aspects of the bomb's development. Two dozen scientists who had been performing related work in Britain, including Neils Bohr, later joined the Los Alamos effort under a secret agreement between Roosevelt and Churchill. At war's end, the work force at Los Alamos numbered over 2,500.

It was initially thought that both uranium and plutonium bombs could be detonated in a gun-type assembly, where one sub-critical mass of fissionable material would be fired into another to achieve the quantity ("super-critical mass") necessary for a nuclear explosion. In early 1944, however, scientists began to suspect that because of the peculiar characteristics of plutonium, the gun-type method would not work fast enough for this material. Their suspicion was confirmed in July 1944, and a major reorganization was made at Los Alamos in August to concentrate on a much more technically difficult detonation technique called "implosion."

The implosion method involved surrounding a sub-critical sphere of plutonium-239 by high explosives that would, when detonated, uniformly compress the plutonium into a super-critical mass within a few millionths of a second. The mechanics of creating such an implosion with the necessary degree of speed and accuracy were, however, untried and considered extremely difficult to perfect.

Work proceeded smoothly on the gun-type assembly for the uranium bomb, but the plutonium bomb would have to be tested before being used in combat; there were still too many unknowns about the implosion device to take the chance of it falling, unexploded, into enemy hands. Further, an atomic test would provide quantitative data on a nuclear explosion that could be collected in no other way.

The site for such a test had to be isolated, have good weather conditions and relatively level terrain, and be within a day's drive of Los Alamos. Eight sites were examined, and in September 1944 an 18 by 24 mile section of the northwest corner of the Second Air Force's Alamogordo Bombing Range was selected. Located in southern New Mexico's Jornada del Muerto (Journey of the Dead Man), just north of the San Andreas Mountains and several miles west of the Oscura Mountains, the site was flat, desolate, and semi-arid (see HAER measured drawings NM-1A, Sheet 1). Oppenheimer gave it the code name "Trinity."[2]

Notes

1. The information about the Manhattan Project presented in this section was gathered from the following sources: Los Alamos Scientific Laboratory, Los Alamos: Beginning of an Era, 1943-1945 (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, n.d); Lansing Lamont, Day of Trinity (New York: Atheneum, 1965); Stephane Groueff, Manhattan Project: The Untold Story of the Making of the Atomic Bomb (Boston: Little, Brown and Company, 1967); Groves, Lester, Now It Can Be Told: The Story of the Manhattan Project (London: Andre Deutsch, 1963).

2. Los Alamos, pp. 32, 33; Kenneth T. Bainbridge, Trinity (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, May 1976), pp. 3, 4; Day of Trinity, pp. 73-76.

TRINITY SITE AND THE TRINITY TEST

Once a decision on the test site had been made, site preparations progressed rapidly. A place near the center of the test area was selected as Ground Zero, and all field instruments and structures were located in precise distances and directions from it (see HAER measured drawings NM-1A, Sheets 2 and 3). All but the heaviest construction was performed by contractors from the local area or by an Army Special Engineering Detachment (SED) stationed at the site.[1]

Drawings of four types of bunkers--for protecting recording instruments, test personnel, motor generators, and cameras--had been prepared at Los Alamos the previous August, and by December 1944 construction was under way. Instrumentation bunkers were erected at points 800 yards west and 800 yards north of Ground Zero, and personnel and generator bunkers at points 10,000 yards north, west, and south. Camera bunkers were built adjacent to the personnel bunkers at 10,000 yards north and west. Later, two additional instrumentation bunkers were erected 600 yards northwest and 1,000 yards north of Ground Zero, and a small firing station was built at 900 yards west.[2]

Administrative and living quarters for test personnel were assembled at the former McDonald brothers ranch nine miles southwest of Ground Zero. This area, called Base Camp, also contained laboratory, maintenance, repair, and related support facilities. By the time of the test, about 325 personnel were housed there, including 250 Los Alamos scientists and support staff, 30 SED personnel, and 45 military police.

Between December and the following May, a 47-mile network of roads was built or upgraded throughout the test site and a 20-mile road constructed between the site and a siding on the Santa Fe railroad in Pope, New Mexico. Several guard posts were built on the test site, with Guard Post 2 at the site's northwest entrance and Guard Post 4 at the southeast entrance.[3]

Telephone and teletype connections with the Mountain State Telephone System's lines provided outside communication to the test site, and a hand-cranked telephone system was used between major points within the site. The main switchboard was located at Base Camp, with a secondary switchboard at the 10,000 South personnel bunker. The 10,000 South switchboard provided service to the personnel and camera bunkers at 10,000 North and West; the instrumentation bunkers at 800 North and West; the tower at Ground Zero; the house at the former George McDonald ranch two miles southeast of Ground Zero; the guard posts at the two entries to the test site; freestanding telephones at 7,000 yards west, 3,000 yards north, west, and south, and 1,500 yards south; and the firing station at 900 yards west.[4]

Radio communications among site personnel were provided on two specially assigned FM channels by a large 50-watt station at Base Camp and six 25-watt stations elsewhere on the test site. Twenty 25-watt Motorola transmitters and receivers were deployed in vehicles. The test area was also equipped with two SCR-299 450-watt ground-to-plane transmitters and two SCR-511 walkie-talkie transceivers for use during the test.[5]

The only sources of elecric power on the test site were a 50 Kw motor generator set that served all of Base Camp; smaller generators in the generator bunkers at 10,000 North, West, and South; two portable generators at the 1,000 North instrument bunker; and a 5 Kw generator at the McDonald ranch house.[6]

The first scientists from Los Alamos arrived in March 1945 and began work on site instrumentation.[7] A variety of field instruments were put in place to measure the effects of a preliminary test explosion that was to be conducted at a site 800 yards south-southeast of Ground Zero. One hundred tons of TNT were stacked on a large timber platform and detonated on May 7 in a spectacular explosion that was visible up to 60 miles away. The 100-ton test proved a successful dress rehearsal for the main test nine weeks later.

Jumbo, an enormous 214-ton cast steel cylinder 25 feet long and 10 feet in diameter, was brought to the test site the same month and erected within a steel tower 800 yards northeast of Ground Zero. Designed a year earlier when prospects for the implosion method's success seemed remote, Jumbo was to serve as a containment vessel for detonating the bomb; in the event of a fizzle, the bomb's precious plutonium could be recovered from Jumbo's steel walls. By the time Jumbo was erected at the test site, however, scientists had gained enough confidence in the implosion method to conduct an open air test, and Jumbo served only as a last-minute standby that was never used.

Construction also began on the tower at Ground Zero in May, and by mid-June it was complete. The tower was a 100 foot high steel structure with a metal shed at its top where the bomb and its detonating device were to be sheltered prior to the test.

In June, alterations were made to the house at the former George McDonald ranch two miles southeast of Ground Zero, which prior to that time had seen little use by test personnel. The northeast room of the house was cleaned and sealed, and benches, electric power, and related equipment were installed in preparation for work on the field assembly of the bomb's active nuclear material.

The instrumentation of the test site began in earnest in April 1945, and as scientists completed their assigned work on the bomb at Los Alamos in May and June, many were sent to Trinity to aid in test preparations. The 100-ton

test of May 7 had helped determine the final field instrumentation arrangements, and the weeks following were a period of intense activity, with site personnel often working 18 or more hours daily. During this period, the 10,000 South personnel bunker often served as a rendezvous where informal meetings were held, and was used as the control bunker for both the May 7th 100-ton test and the main test on July 16.[8]

At the direction of the scientists, miles of above-ground and buried signal cables were laid between the hundreds of field instruments that covered the desert and their associated timing devices at the 10,000 North, West, and South personnel and camera bunkers. The field instruments were designed to collect information on the nuclear implosion process; the completeness and efficiency of the nuclear reaction; the bomb's nuclear, air blast, and earth shock effects; and the behavior of its fireball.[9] Many instruments were exposed above-ground, while others were buried or placed in the instrument bunkers at 1,000 North and 600 Northwest. A number of instruments were suspended, hours before the explosion, from weather balloons. Several weeks before the test, high speed Fastax cameras, which were to be located within the 800 North and West bunkers, were instead mounted on lead-lined sleds located adjacent to the bunkers. Long cables were attached to the sleds to enable them to be pulled away from the test area within hours of the explosion.[10]

Test instruments and recording devices included fast oscilloscopes, electron multiplier chambers, ionization chambers, cellophane catcher cameras, sulphur threshold detectors, gold foil detectors, quartz Piezo gauges, condenser gauges, moving-coil loudspeaker pickups, piston gauges, crusher gauges, geophones, seismographs, high speed cameras, motion picture cameras, pinhole cameras, gamma ray recorders, and spectrographs.[11]

On July 13, the bomb's plutonium core components were assembled in the northwest room of the George McDonald ranch house, then brought to the base of the tower at Ground Zero where the core was inserted into the bomb's high explosive assembly. The following morning the bomb was hoisted to the top of the tower and, in a long and dangerous job that lasted until late in the day, the bomb's explosive detonators were connected.[12]

On July 15, final checks were made on the signal and timing devices that would detonate the bomb and activate the field instruments and test recording equipment. That evening an arming party connected the detonating circuits at the top of the tower, and at 4:45 A.M. the next morning, 45 minutes before detonation, they closed the arming switches at the tower's base and the signal switches at the firing station at 900 West.[13]

The Trinity test had been firmly established for 4:00 A.M. on Monday, July 16. An intense rainstorm that had begun the night before caused its postponement for one and a half hours, but at 5:10 A.M. the countdown began.[14]

The control bunker at 10,000 South was occupied by 27 men, including project director J. Robert Oppenheimer, Brigadier General Thomas Farrell, test director Kenneth Bainbridge, assistant test director John Williams, explosives division leader George Kistiakowsky, and the head of bomb assembly group, Commander Norris Bradbury. Twenty-two men, under the direction of John Manley, were assigned to 10,000 North, and 24 men, led by Robert Wilson, were stationed at 10,000 West. Prior to and during the test, searchlight crews at the North and West sites trained their highpowered lights on the tower at Ground Zero. Medical personnel were positioned in the personnel bunkers at all three 10,000 yard sites and took continuous ambient radiation readings following the explosion.[15]

At Base Camp, the test was viewed from a dirt embankment by the remainder of the Trinity personnel, as well as by General Groves and such distinguished guests as Vannevar Bush, head of the government's Office of Scientific Research and Development; his assistant, James B. Conant, president of Harvard University; and Enrico Fermi, the famed physicist.[16]

Approximately twenty miles northwest of Ground Zero, three busloads of Los Alamos personnel and a number of other observers watched the test from atop Campaña Hill. Among the observers were Ernest O. Lawrence, Edward Teller, Hans Bethe, Sir Geoffrey Taylor, and Sir James Chadwick.[17]

The detonation occurred at 5:29:45 A.M. (see HAER measured drawings NM-1A, Sheet 4). General Farrell described the explosion as follows:

> The effects could well be called unprecedented, magnificent, beautiful, stupendous, and terrifying. No man-made phenomenon of such tremendous power had ever occurred before. The lighting effects beggared description. The whole countryside was lighted by a searing light with the intensity many times that of the midday sun. It was golden, purple, violet, gray, and blue. It lighted every peak, crevasse, and ridge of the nearby mountain range with a clarity and beauty that cannot be described but must be seen to be imagined. Seconds after the explosion came, first, the air blast pressing hard against the people, to be followed almost immediately by the strong, sustained awesome roar which warned of doomsday and made us feel we puny things were blasphemous to dare tamper with the forces heretofore reserved for the Almighty.[18]

Enrico Fermi's account was this:

> My first impression of the explosion was the very intense flash of light, and a sensation of heat on the parts of my body that were exposed. Although I did not look directly towards the object, I had the impression that suddenly the countryside became brighter than in full daylight. I subsequently looked in the direction of the explosion through the dark glass and could see something that looked like a conglomeration of flames that promptly started rising. After a few seconds the rising flames lost their brightness and appeared as a huge pillar of smoke with an expanded

> head like a gigantic mushroom that rose rapidly beyond the clouds, probably to a height on the order of 30,000 feet. After reaching full height, the smoke stayed stationary for a while before the wind started dispersing it.[19]

Hans Bethe described it similarly:

> It looked like a giant magnesium flare which kept on for what seemed a whole minute but was actually one or two seconds. The white ball grew and after a few seconds became clouded with dust whipped up by the explosion from the ground and rose and left behind a black trail of dust particles. The rise, though it seemed slow, took place at a velocity of 120 meters per second. After more than half a minute the flame died down and the ball, which had been a brilliant white, became a dull purple. It continued to rise and spread at the same time, and finally broke through and rose above the clouds which were 15,000 feet above the ground. It could be distinguished from the clouds by its color and could be followed to a height of 40,000 feet above the ground.[20]

The explosion yielded about 15,000 tons of TNT equivalent. Because most field instruments were set up for a detonation not expected to exceed 5,000 tons, many of the test devices were damaged or destroyed by the blast's intense heat, shock, and radiation effects. Gamma ray emissions blackened the film in many recording instruments within 1,000 yards of Ground Zero. The electromagnetic impulse given off by the bomb disrupted signals in the shielded cables that ran from site instruments to recorders at the 10,000 yard bunkers, causing a loss of data from many of the close-in experiments. The blast destroyed the several weather balloons that carried airborne instruments.[21]

Some data on delayed neutrons were gathered from the cellophane catcher cameras at 600 Northwest, and usable readings were obtained from many of the field gauges, geophones, seismographs, and other site equipment. Most of the cameras at 10,000 North and West worked well during the test, as did the Fastax cameras on the lead-lined sleds at 800 North and South. Over 100,000 frames of film were exposed and later analyzed at Los Alamos.[22]

Shortly after the test, a lead-lined tank entered the area near Ground Zero and retrieved soil samples by use of rocket-fired ground scoops. These samples, with other ground and airborne matter, were analyzed at Los Alamos to determine the completeness and efficiency of the atomic reaction.[23]

Three weeks after the Trinity test, on August 6, 1945, the first combat atomic bomb, a uranium-based device, was dropped on Hiroshima, Japan, with devastating effect. Sixty percent of the city was destroyed, and 78,000 civilians were killed, 37,000 wounded, and 13,000 declared missing, far exceeding the expectations of the American forces.[24]

On August 9, a plutonium-based bomb similar to that tested at Trinity Site was dropped on Nagasaki, Japan. Its blast completely destroyed an area one mile in diameter and caused 75,000 casualties.[25]

On August 14, the Japanese surrendered and World War II came to an end.

The following sections describe in detail the buildings, structures, and related equipment and facilities used for the test at Trinity Site.

Notes

1. Lansing Lamont, Day of Trinity (New York: Atheneum, 1976), p. 120; Los Alamos Scientific Laboratory, Los Alamos: Beginning of an Era, 1943-1945 (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, n.d.), p. 34. A construction company from Albuquerque directed by Ted Brown was the major local contractor at Trinity Site according to Ferene Morton Szasz, The Day the Sun Rose Twice: The Story of the Trinity Site Nuclear Explosion, July 16, 1945 (Albuquerque, New Mexico: University of New Mexico Press, 1984), pp. 32-34.

2. Most specific references in this section to site and construction data are provided in later sections of the report, unless otherwise noted.

3. Lansing Lamont, unpublished papers for Day of Trinity, p. 98, Harry S. Truman Library, Independence, Missouri; Trinity memorandum dated 7 December 1944 from Davalos to file, Record Group A-84-019, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico; Trinity Site photograph TR-284, Los Alamos National Records Center/Archives, Los Alamos, New Mexico.

4. Trinity memorandum dated 12 June 1945 from Cdr. Keiller.

5. Kenneth T. Bainbridge, Trinity, (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, May 1976), p. 13; Trinity memorandum dated 12 June 1945 from Bainbridge.

6. Trinity memoranda dated 7 December 1944 from Capt. Davalos to file, 9 March 1945 and 21 April 1945 from Mack to Williams, 30 May 1945 from Kupferberg to Keiller, and 23 April 1945 and 24 April 1945 from Williams to Davalos.

7. Los Alamos, pp. 34-42.

8. Day of Trinity, p. 46; unpublished oral interview by Edwin C. Bearss, National Park Service, with Bob Krohn, Berlyn Brixner, John Manley, and Joe McKibben at Trinity Site, June 1968, p. 42; Los Alamos, pp. 43-51.

9. Trinity, pp. 1-9, 45-69.

10. Bearss interview, pp. 14, 21.
11. Trinity, pp. 45-69.
12. Day of Trinity, pp. 170-173.
13. Ibid., pp. 218-219.
14. Ibid., pp. 220-235.
15. Ibid., pp. 221-231; Trinity, pp. 31-33.
16. Day of Trinity, pp. 235-256; Trinity, p. 51.
17. Day of Trinity, pp. 235-256.
18. Los Alamos, p. 53.
19. Ibid., p. 53.
20. Ibid., p. 53.
21. Trinity, pp. 45-69.
22. Ibid., pp. 45-69.
23. Ibid., pp. 45-69.
24. Day of Trinity, pp. 265-266.
25. Day of Trinity, pp. 265-266.

BASE CAMP

Background

Base Camp was located about 9 miles southwest of Ground Zero at the former McDonald brothers ranch (not to be confused with the George McDonald ranch two miles southeast of Ground Zero, where the bomb's plutonium core was assembled). A small contingent of military police took up residence at Base Camp in December 1944, and by the time of the test seven months later, its population had grown to about 325 scientific, civilian, and military personnel. Little has been recorded about the actual activities at Base Camp, but it was from a bank on the camp's earthen reservoir that most of the Trinity personnel observed the test on July 16, 1945.[1]

Structures

When the Army took possession of the McDonald brothers ranch in 1944, it was a working ranch and possessed a number of structures, including two ranch houses, several outbuildings, an earthern reservoir, two or more windmills, and a water tank.[2]

Of the two ranch houses, the easternmost was an H-shaped one-story adobe structure. Facing east, it had a central section about 20 by 30 feet, flanked on the north and south by two wings. The north wing was about 35 feet long and 20 feet wide, and the south wing about 50 feet long and 25 feet wide. A west-facing porch stood between the wings on the west side of the central section, and a north-facing porch shielded the north, extended side of the south wing. A pitched roof covered the center section of the building and the west porch, while both wings and the north porch had shed roofs. Exterior and interior walls were adobe, and all roofs were corrugated metal. Windows appear to have been four-over-four wood sash. At least one interior room had a small fireplace.[3]

Test personnel first occupied the ranch house in December 1944, when a detachment of military police arrived on site. Referred to as "ranch house number 2," it served both as laboratory space and as Base Camp's headquarters. Telephone service and electric power were brought to the building, and a telephone switchboard was installed in one of the rooms.[4]

The other ranch house stood several hundred feet west of the first and faced north. It was a simple, rectangular wood frame structure that measured approximately 25 by 40 feet, with an addition about 20 feet wide that ran the full length of the building's north (long) side. Exterior walls were sheathed in tongue-and-groove horizontal siding and the gabled roof was covered with corrugated metal. Windows appear to have been four-over-four wood sash, except on the north addition, where historic photographs show three windows with six lights each. The house had no fireplaces, and apparently used a stove for heating.[5]

This building, assigned for use as a laboratory in March 1945, was referred to as "ranch building number 1." A photographic trailer was backed up to its south side and a standard Army hutment was later attached to its north side. The Army also provided the building with three-phase electric power, and running water for processing photographs.[6]

Several outbuildings stood near the houses. A small wood shed, approximately 8 feet square, was located about 40 feet west of the second ranch house, and two adobe structures were located between the house and the earthen reservoir to its north. One of the adobe structures was about 20 feet square and appears to have been a barn or garage. The other was about 15 by 25 feet. Historic photographs show what appears to have been a pump jack (power transfer or "walking" beam) between this building and the windmill just north of it. It is likely that, previous to the Army's occupation, either the windmill had provided power to a DC generator and battery set inside the building or that a gasoline motor inside the building was sometimes used to drive the windmill's pump shaft. The wood shed and the two adobe structures were covered by corrugated metal roofs.[7]

Another outbuilding, measuring about 10 by 15 feet, was located between the two ranch houses. This was referred to as a garage, and in December 1944 the Army poured a concrete floor to hold a 50 Kw motor generator plant.[8] Historic photographs show that by mid-1945 two additions had been made to the building, perhaps to hold additional generating equipment. This location probably provided all the electric power for Base Camp. The garage appears to have been of wood frame construction with a corrugated metal roof and wood siding. Both its additions seem to have been of similar construction but had roof and wall coverings of asphalt-impregnated roofing felt (tarpaper).[9]

Numerous Trinity Site memoranda refer to a "ranch building number 3" or a "southwestern ranch building" at Base Camp. It was assigned to laboratory use in March 1945 and must have been enclosed and habitable. The building may have been the larger of the two adobe outbuildings described above, although both structures are in the northwestern part of the site and historic photographs show few signs of activity around them. It is more likely that "building number 3" was a barn south of the ranch houses; historic photographs show a building slightly higher and seemingly bigger than its surrounding CCC structures in the center rear of the Base Camp complex. Although its location is inconclusive, several improvements were made to the building by the Army in 1945, including the installation of work tables, shelving, and three-phase electric power.[10]

A rectangular earthen reservoir, located north of the ranch complex, measured several hundred feet long on each of its sides. Its banks rose about 10 feet above grade level at their highest point. The reservoir was normally dry, but it sometimes filled during the rainy season. A Chicago Aermotor windmill on a wooden tower stood on the outer edge of the southwest bank of the reservoir. This was the windmill whose pump shaft appears to have been connected to machinery inside the closest of the two adobe outbuildings.[11]

A number of operational wells existed at the ranch. An historic photograph dated April 5, 1945 shows a well drilling rig near the windmill on the reservoir; the rig may have been used to clean, deepen, or reopen an existing well or to drill a new one. Another photo, dated April 10, 1945, shows a large metal water storage tank being unloaded nearby, and slightly later photographs show the tank atop a timber platform on the southwestern corner of the reservoir. The tank platform measured about 10 by 12 feet and stood approximately 8 feet high. It had bolted connections and rested on a concrete foundation. An adjacent platform, which historic photographs show had a smaller tank, was of similar but lighter construction. It measured about 10 by 10 feet, and stood about 10 feet high above its concrete foundation. Well water at Base Camp was highly alkaline and normally served only washing, cleaning, and other non-potable uses. Tank trucks brought in potable water from the Rio Grande at Socorro.[12]

In November 1944, contracts were let for the construction of new buildings at Base Camp. Ten Civilian Conservation Corps (CCC) portable buildings were dismantled and shipped in from Albuquerque, including four 20x100-foot units, a 20x60-foot unit, a T-shaped mess hall and kitchen, three 20x50-foot units, and a 150-man latrine. These were erected south of the ranch houses. Sometime between April and June, at least one additional 20x100-unit was added to the complex and the latrine was expanded. Four of the 20x100-foot units were used for barracks. The remaining 20x100-foot unit, the 20x60-foot unit, and the three 20x50-foot units (two of which were apparently attached end-to-end) served various supply, shop, and office functions. Around May an evaporative cooler was added to the mess hall, but this may have been the only building with a mechanical cooling device at Base Camp.[13]

In addition, approximately 20 standard Army hutments, each about 15 feet square, were set up in and around the Base Camp complex between March and June, 1945. Like the CCC buildings, they were used for a variety of office, supply, and shop functions.[14]

Water was brought up from the wells at Base Camp by two 20 gpm electric pumps and stored in the tanks atop the reservoir. A non-potable water distribution system linked the storage tanks to the mess hall kitchen and the latrines, and a sewage system carried waste water from these two facilities to a cesspool located west of camp. Electric power was supplied via overhead lines from the generator building between the two ranch houses, and a public address system was installed throughout the camp.[15]

The main telephone switchboard at the headquarters building handled communications from hand-cranked telephones at the headquarters office, the laboratory building, the orderly room at the infirmary, the supply room, the electronics shop, the post engineer's office, the fire station, the motor pool, the wire service office at Base Camp, and the switchboard at 10,000 South.[16]

Present remains

Little is left of either the McDonald Brothers ranch or Base Camp. The only buildings that remain are the two ranch houses and a small wood shed west of them. All three were abandoned after the test and are now deteriorated (see HAER photographs Nos. NM-1A-1 and NM-1A-2). The wood ranch house is roofless and near collapse. The roof of the adobe ranch house is still relatively sound, and the structure's adobe walls are largely intact. Neither building has windows or doors. No evidence remains of the ranch's two adobe outbuildings, nor of a possible "ranch building number 3." The garage (and its Army-built additions where Base Camp's electric generators were housed) is gone, but its concrete floor still remains.[17]

Subsequent to the test, all the CCC buildings and Army hutments were removed, and only the concrete floors of the latrine and one other building (probably the motor pool) survive. The two water tank platforms are still intact, and the water tank installed by the Army in April 1944 remains atop one of them (see HAER photographs Nos. NM-1A-2 and NM-1A-3). The earthen reservoir is eroded but still recognizable. Only a close inspection of the site reveals any evidence of the unique Army camp that existed there in 1945.

Notes

1. Los Alamos Scientific Laboratory, Los Alamos: Beginning of an Era, 1943-1945 (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, n.d.), p. 34; Kenneth T. Bainbridge, Trinity (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, May 1976), p. 25; Lansing Lamont, Day of Trinity (New York: Anteneum, 1965), pp. 233-256.

2. Trinity Site photographs TR-54, 221, and 280, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico.

3. Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) inventory card for McDonald Brothers Ranch, White Sands Missile Range, New Mexico, 1983; site investigation by William A. Brenner, Building Technology Inc., February 1983.

4. Trinity memorandum dated March 24, 1945 from Bainbridge, Record Group A-84-019, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico.

5. HABS/HAER inventory card for McDonald Brothers Ranch; site investigation by Brenner.

6. Trinity memoranda dated 23 April 1945 and 30 March 1945 from Williams to Davalos, and 9 April 1945 and 24 March 1945 from Bainbridge; Trinity Site photograph TR-54.

7. Trinity Site photographs TR-54, 55, and 221.

8. Trinity memorandum dated 7 December 1944 from Davalos to file.

9. Trinity Site photograph TR-280.

10. Trinity memoranda dated 30 March 1945, 9 April 1945, and 23 April 1945 from Williams to Davalos, and 12 June 1945 from Keiller.

11. Site investigation by Brenner; Trinity Site photographs TR-54 and 221.

12. Trinity Site photographs TR-55 and 56; Day of Trinity, pp. 122-124; undated and unsigned Trinity memorandum re: well drilling.

13. Trinity memoranda dated 10 October 1944 from Bainbridge to Oppenheimer and 23 April 1944 from Williams to Stevens; Trinity Site photograph TR-390.

14. Trinity memoranda dated 30 March 1945 from Williams to Davalos and 23 April 1945 from Williams to Stevens.

15. Trinity memoranda dated 10 October 1944 from Bainbridge to Oppenheimer and 1 June 1945 from Bainbridge to Keiller; Trinity Site photographs TR-54, 221, and 280.

16. Trinity memoranda dated 24 March 1945 from Bainbridge and 12 June 1945 from Keiller.

17. Site investigation by Brenner.

100-TON TEST

Background

The structure for the 100-ton test, located 800 yards south-southeast of Ground Zero, was a 25 foot by 25 foot heavy timber platform 20 feet high on which were stacked high explosives with an equivalent detonating power of 100 tons of TNT. Designed by the engineering section at Los Alamos, the platform was constructed at the Trinity site in March and April 1945.[1]

In late April, 3590 boxes of TNT and 774 boxes of Composition "B" (a high explosive mixture of RDX and TNT) were delivered by rail from Fort Wingate in Gallup, New Mexico, to the Trinity siding at Pope, then transported by truck to the 100-ton test site. A crew of approximately 18 men stacked the material on the platform's deck to a height of about 14 feet. One-inch-thick planks with cleats on their ends were inserted between the layers of high explosives to keep the stack stable.[2]

A one-thousand curie liquid solution containing traces of plutonium-239 from the Hanford reactors was poured into tubes that had been inserted within the explosives pile. This radioactive material was to simulate some of the radiation effects expected from the nuclear test.[3]

At 4:37 a.m. on May 7, 1945, the pile was detonated in a huge explosion whose brilliant orange fireball was observed 60 miles away. The test was considered highly successful by the Los Alamos scientists, and provided valuable information for calibrating instruments, improving communications, and tightening field organization.[4]

Structure

The 25 by 25 by 20 foot high test platform rested on sixteen 12 inch by 12 inch timber columns, four rows wide and four rows deep, which were supported on concrete piers approximately 6 feet on center. The columns were tied by horizontal wood members at midlevel on the platform's east and west sides, and at points one-third and two-thirds up the north and south sides. Each column was heavily crossbraced and all connections were bolted. Heavy timber beams rested atop the north-south rows of columns, with the beams and columns tied by large steel bolting plates. The beams supported 3 by 12 inch platform joists on 16 inch centers, and the joists were covered by heavy wood decking.[5]

A wood stair was built from the ground on the tower's west side to the top of the platform's southwest corner. From there it continued upward along the platform's south edge, turning inward 45 degrees near the southeast corner and ending at a point about 14 feet above the platform, the height at

which the high explosives were to be stacked. A wood hoisting tower was erected adjacent to the north edge of the platform. It was about four feet square and rose 20 feet above the platform for a total height of about 40 feet. Hoisting sheaves were placed atop the tower. The hoist mechanism, probably motor-operated, was located at grade level.[6]

Numerous measuring instruments were placed around the 100-ton test site, their distance scaled to the expected 4000-5000 ton TNT-equivalent nuclear explosion that was to take place six weeks later. A coaxial cable laid between the platform and the control shelter at 10,000 South served as the firing circuit for the test.[7]

Two firebreaks were created around the test site. The first was a clearing around the platform with a radius of 200 yards. The second was a concentric ring 90 feet wide with an inner radius 350 yards from the platform. These firebreaks are visible in the aerial photographs taken of Ground Zero shortly after the test.[8]

Present remains

The 100-ton explosion created a shallow crater several feet deep and about 30 feet in diameter.[9] A number of the platform's concrete footers and a few timber remnants, presumably from the platform's structure, were located during a site investigation in 1968 and probably still remain on the site.[10]

Notes

1. Trinity memoranda dated 25 November 1944 and 15 March 1945 from Bainbridge to Davalos, and 19 March 1945 from Bainbridge to Kistiakowsky, Record Group A-84-019, Los Alamos National Laboratory Records Center/ Archives, Los Alamos, New Mexico.

2. Trinity memorandum dated 19 March 1945 from Bainbridge to Kistiakowsky (with 24 March revision); Los Alamos Scientific Laboratory, Los Alamos: Beginning of an Era, 1943-1945 (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, n.d.), pp. 35-42.

3. Kenneth T. Bainbridge, Trinity (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, May 1976), pp. 7-14.

4. Ibid., pp. 42-43.

5. Trinity Site photographs TR-64, 67, 68, 95, 96, 99, 100, 175, 178, and 216, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico; Trinity memorandum dated 20 March 1945 from Bainbridge to Williams.

6. Trinity Site photographs TR-67 and 68.

7. Trinity, pp. 7-14.

8. Trinity memorandum dated 17 April 1945 from Williams to Davalos.

9. Trinity, p. 12.

10. Unpublished oral interview by Edwin C. Bearss, National Park Service, with Bob Krohn, Berlyn Brixner, John Manley, and Joe McKibben at Trinity Site, June 1968, pp. 35-37.

JUMBO

Background

In March 1944, Oppenheimer requested the construction of a "sphere for proof firing" the implosion-type plutonium bomb. At that time, work on the implosion device was encountering great difficulty, and scientists sought a means of recovering the bomb's plutonium-239—then in extremely scarce supply—in the event of a test failure. Among the suggestions for achieving this was "Jumbo," an enormous steel container in which the bomb could be detonated.[1]

By May, a number of scale model "Jumbinos" were being tested at Los Alamos to determine the best configuration for such a vessel. Specifications required that it completely contain the force of the bomb's high explosives and permit the mechanical and chemical recovery of the bomb's unexploded plutonium.[2]

It took over thirteen months to design, build, and install the vessel at the test site. By then, however, Los Alamos scientists were much more confident that the implosion device would work, and the decision was made to conduct a conventional, open air test. Nevertheless, Jumbo was readied as earlier planned in the event that a last minute test change would require its use.[3]

Structural Description

Jumbo was a 214-ton cast steel cylinder 25 feet long and 10 feet in diameter. It had hemispherical ends, one with a protruding neck about 16 inches long and 4-1/2 feet in diameter that provided an opening to the cylinder's interior. The vessel's walls were 6 inches thick, with an additional 8 inches of wrapped steel covering its central cylindrical section.[4]

A heavy cast steel cap about 2 feet long and five feet in diameter fit over the vessel's neck. It had four large triangular lifting flanges on its top and approximately 20 movable steel pins positioned around its base. The pins fit into matching holes in the neck of the cylinder, and served as the means of securing the cap to the vessel.[5]

Specifications for Jumbo's construction were developed at Los Alamos in early 1944, but it took some time to find a company willing to attempt the vessel's fabrication. The Babcock and Wilcox Company of Barberton, Ohio, finally contracted to do the work, which was completed during the winter of 1944-45. Jumbo was shipped from Ohio to New Mexico on a specially built flat car via a roundabout route that avoided bridges and tunnels too small to accommodate its huge bulk. It arrived at a rail siding in Pope, New Mexico, in May 1945, and was towed by Army D7 bulldozers 28 miles across a newly built road in the desert to a site 800 yards northeast of Ground Zero in a specially designed 64-wheeled trailer.[6]

Once Jumbo was positioned on-site, a steel tower was constructed to hoist the vessel into an upright position. Work on the tower's concrete footings began in early June, and the tower was completed by the first of July.[7] Built of bolted I-beam sections, it measured about 60 feet tall and 18 feet square at the base, its four legs tied by horizontal framing members at the 15, 30, 45, and 60 foot levels. The tower was cross-braced at every level except on the lowest two levels of its south side, where the horizontal framing member at the 15 foot level was also omitted, providing the clearance for Jumbo to be hoisted upright. An additional horizontal member was inserted near the 30 foot level to compensate for these missing structural components.[8]

A high-ratio pulley system was suspended from four large I-beams at the top of the tower and connected to Jumbo's neck. It appears that the hoisting mechanism was located on the ground, or that a crane (shown in the historic photographs) provided the hoisting power.[9] After Jumbo was lifted approximately six feet in the air, a 24 inch deep concrete foundation pad was poured beneath it in a hole about 7 feet below grade. The vessel was then lowered until it touched the pad and a second pour was made that completely encased its lower hemispherical end. This brought the bottom of the steel-wrapped central portion of the cylinder to rest at about ground level. During the hoisting operation the tower was guyed, but the guys were removed after Jumbo was set in place.[10]

Prior to the July 6 test, the pulley system was removed from the tower and two guy lines extending from the general direction of Ground Zero were attached to Jumbo's neck. The vessel's cap was not used during the hoisting process or during the test.[11]

Personnel from the Eichleay Construction Company of Pittsburgh, Pennsylvania unloaded Jumbo from its rail car, transported it to the site, erected the tower, and set the vessel in its final position.[12]

Present remains

Jumbo survived the July 16 explosion, 800 yards to its southeast, completely intact, although it was knocked slightly askew with a tilt several degrees away from the direction of the blast. Records do not indicate whether the vessel rotated slightly on its concrete foundation or if the foundation itself was tilted or broken.[13]

The explosion snapped the two guy wires holding Jumbo, and collapsed its surrounding tower. The two tower legs closest to Ground Zero were pulled from the ground with their concrete footings attached, and the structure, which was designed only as a lifting device and had little lateral stability, was virtually flattened.[14]

The tower wreckage was removed from around Jumbo sometime after the test, and attempts were made to salvage the steel in Jumbo itself. Both hemispherical ends were eventually destroyed by explosives and the 8 inch steel sheath surrounding the vessel's center section was removed. Jumbo's remaining shell lay half buried in the sand until the mid-1960s, when it was moved to the entrance of Ground Zero (see HAER photographs Nos. NM-1A-4 and NM-1A-5). There are no visible remnants at Jumbo's tower site, although the foundation on which the tower rested undoubtedly remains beneath the sand.[15]

Notes

1. Trinity memorandum dated 15 March 1945 from Brainbridge to Henderson, Record Group A-84-019, Los Alamos National Laboratory Records Center/ Archives, Los Alamos, New Mexico.

2. Los Alamos Scientific Laboratory, Los Alamos: Beginning of an Era, 1943-1945 (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, n.d.), p. 31.

3. Ibid., pp. 31, 32; Kenneth T. Bainbridge, Trinity, (Los Alamos Scientific Laboratory, May 1976), pp. 4, 5.

4. Unpublished oral interview by Edwin C. Bearss, National Park Service, with Bob Krohn, Berlyn Brixner, John Manley, and Joe McKibben at Trinity Site, June 1968, p. 19; Los Alamos, pp. 31, 32.

5. Trinity Site photographs TR-34, 179, and 249, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico.

6. Los Alamos, pp. 31, 32; Trinity Site photographs TR-34, 38, and 157.

7. Trinity memorandum dated 25 May 1945 from Williams to Keiller; Los Alamos, p. 31.

8. Trinity Site photographs TR-179 and 249.

9. Ibid.

10. Ibid.; Trinity memorandum dated 22 June 1945 from Henderson and Carlson to Bainbridge.

11. Trinity Site photographs TR-131 through 134 and 249.

12. Trinity memorandum dated 15 March 1945 from Bainbridge to Henderson. The Eichleay Construction Company is still in business in Pittsburgh.

13. Bearss interview, pp. 20, 21; Trinity Site photographs TR-131 through 134.

14. Trinity Site photographs TR-132 and 133.

15. Bearss interview, p. 19.

MCDONALD RANCH

Background

The George McDonald ranch, two miles southeast of Ground Zero, was a well developed southern New Mexico cattle ranching complex with a variety of outbuildings and farming appurtenances when acquired by the Army in 1944.[1]

Located near the center of the Trinity test site, the ranch was no doubt used to some degree by the military police after they occupied the area in December 1944. The MPs had horses, and a contemporary photograph indicates that they may have been stabled at the ranch. Other records describe instances when test personnel used the ranch's concrete reservoir as a swimming pool, apparently a common occurrence in the warmer months.[2]

A request in March 1945 for the installation of an oil heater in the ranch house indicates that it may have been occupied, perhaps during the day, by MPs, scientists, or construction workers.[3] Otherwise, the ranch house does not seem to have been actively used until July 1945 when it was selected as the site for the final assembly of the bomb's plutonium core components. In June, Los Alamos personnel directed that the following alterations be made to the building's northeast room:[4]

1) the installation of two work benches 9'-6" long, 2'-3" wide, and 3'-4" high along the west and north walls,

2) the covering of one of the windows (since there were two windows in the northeast room, it is likely that both windows were covered to make them dust-tight),

3) the installation of two 100 watt ceiling lights,

4) the installation of two electrical outlet boxes above the work benches, and

5) the installation of a telephone.

Electricity for the ranch house was to be provided by a 5 Kw generator. Another directive called for the installation of a steel beam below the ceiling in the northeast room.[5] The beam was to be supported by two wood posts and to hold a half-ton Yale chain hoist (it is not clear whether this was ever installed). Sometime previous to July 12 a raised deck and ramp were built over the porch from grade level to the level of the floor of the northwest room.[6]

On July 12, the bomb's plutonium core components were loaded into a sedan at Los Alamos and driven to the ranch house, where they were stored overnight. The northwest room of the house had been carefully cleaned and

vacuumed, and its windows and doors sealed with black tape. The following morning a team of six to eight scientists, led by Robert Bacher and Marshall Holloway and assisted by Louis Slotin, entered the room and began the final assembly of the plutonium core. The assembly process was completed about mid-afternoon with the insertion of the nuclear initiator at the core's center. Others present during the assembly process included Robert Oppenheimer, Norris Bradbury, and Brigadier General Thomas Farrell.[7]

Once assembled, the core was taken by car directly to the base of the tower at Ground Zero, where it was encapsulated in the center of the bomb.[8]

Structures

The ranch's single house was built of adobe and had a corrugated metal roof. The main body of the house was rectangular in plan, measuring 36 by 32 feet, with its long (front) side facing east. It had four rooms, one of which was a kitchen, with a crawl space located under the northwest room. Exterior and interior walls were covered with adobe plaster. The southeast room, which probably served as a parlor or dining room, had walls decorated with a stenciled design that bordered the ceiling.[9]

Two additions projected from the body of the house, one on the north and one on the west. The north addition, containing two rooms, was 15 by 21 feet and built of rubble stone with adobe mortar. The stone was left exposed on the exterior and covered with adobe plaster on the interior. The west addition was an ice house 11 by 16 feet, separated from the main structure by a five foot wide covered porch. The ice house was built of rubble stone with adobe mortar and covered with abobe plaster on both the interior and exterior. It had two closet-sized rooms and a stair leading to a small basement where ice was stored.

A wood porch, 7 feet deep and 20 feet long, covered a large portion of the east facade. The porch had wood railings and balusters but was otherwise unadorned. Two doors from the porch led into the house, one to the southeast room and one to the northeast room. The north addition also had two exterior doors, one from each room, and a door off the kitchen opened onto the porch between it and the ice house.

The main body of the house had eight two-over-two wood sash windows, seven of which were about 2-1/2 feet wide and 5 feet high. The north addition had five two-over-two wood sash windows, one of which was about 2-1/2 feet square, with the remaining four about 2-1/2 feet wide and 4-1/2 feet high. Two of the four formed a double window on the addition's east side.

The house had two chimneys but no fireplaces, and there were flue openings in several rooms. Records show the existence of a 540 gallon underground butane storage tank; the tank was probably used to supply fuel for cooking and domestic heating and is most likely buried somewhere near the house.[10]

The building's metal roof was supported by wood sheathing over conventional wood framing. The sheathing appears to have been mill-cut, but much of the framing was hand-cut.

A cistern, 9 feet deep and 7 feet in diameter, was located just west of the house and stored water collected from the roof. Surrounding the house was a low stone wall, about four feet high and a foot thick, made of rubble and adobe mortar.

About 20 feet west of the ice house stood a steel windmill tower (of unspecified use), and just outside the northwest corner of the stone wall was a 6 by 7 foot root cellar with concrete walls, a dirt floor, and a timber and metal roof covered by a shallow layer of dirt. A narrow outside wood and earth stair led down to the root cellar's corrugated metal door.

Approximately 90 feet east of the house stood a large above-ground concrete water reservoir. It was 65 feet long, 20 feet wide, and 6 feet deep, with two compartments of approximately equal size. The reservoir was fed by a windmill located about twenty feet to its east. Ten inch square wood timbers with bolted connections formed the windmill's tower, which measured 14 feet square at the base and 27 feet high and held a Chicago Aermotor mill with a metal blade rotor seven feet in diameter. The mill was connected to a wood sucker rod that fed into a 385 foot deep well with a six inch casing and three inch well pipe.[11]

Several yards south of the reservoir was an L-shaped bunkhouse built of rubble stone and adobe mortar. A corrugated metal roof covered four small rooms. Three of the rooms formed a rectangle 15 by 35 feet, with the fourth room, which measured 10 by 20 feet, adding an ell to the building. The largest three of the four rooms had fireplaces. A 12 foot deep cistern with a diameter of 9 feet was located adjacent to the south wall of the bunkhouse.

A large barn and garage, 41 feet wide and 71 feet long, stood about 20 feet south of the bunkhouse. It had two rooms on its west end, each about 12 by 20 feet, and a large clear central interior area about 38 by 50 feet. The structure had rubble walls with adobe mortar and was covered by a corrugated metal roof. An assortment of materials was used in the building's framing, including sections of small gauge steel railroad rails.

Adjacent to the east side of the barn stood several corrals, holding pens, and metal watering troughs. A number of corrugated metal outbuildings, including a general purpose shed, a saddle shed, a poultry house and shed, and a hog house also occupied the area. The corrals were made of planks, wire on cedar posts, and a variety of other materials including telephone cross-ties.

Present remains

The atomic explosion of July 16 damaged the roof of the barn and possibly the roofs of some of the other outbuildings. It broke some or all of the windows in the ranch house, and caused some damage to the north roof. It may also have collapsed the ranch house's chimneys, although no formal assessment was made of damages at the time.[12]

The McDonald ranch stood abandoned after the test until 1983, when efforts were undertaken to restore the ranch house. By that time most of the outbuildings and portions of the ranch house were in poor condition and partially vandalized (see HAER photographs Nos. NM-1A-6 through NM-1A-69). The ranch house's windows and doors were partially or completely missing, its porch roof collapsed and its porch deck rotted, the stucco on its east facade eroded, and the stone wall surrounding it in disrepair.

Measured drawings of the ranch house were completed by the Historic American Engineering Record in early 1983 (see HAER measured drawings NM-1A, Sheets 5-11). The house was restored to its condition at the time of the Trinity test by the White Sands Missile Range and the National Park Service in 1983-84. Dedication of the restored house took place on November 20, 1984.

Notes

1. Trinity Site photographs TR-53, 244, 277, and 312, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico.

2. Unpublished oral interview by Edwin C. Bearss, National Park Service, with Bob Krohn, Berlyn Brixner, John Manley, and Joe McKibben at Trinity Site, June 1968, p. 38.

3. Trinity memorandum dated 8 March 1945, minutes of meeting of Bainbridge, Davalos, Stevens, and Williams, Record Group A-84-019, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico.

4. Trinity memorandum dated 11 June 1945 from DeWire to Keiller.

5. Bearss interview, p. 39.

6. Historic American Engineering Record (HAER) measured drawings for McDonald Ranch at Trinity Site, NM-1-A, Sheet 7, Historic American Buildings Survey/Historic American Engineering Record, National Park Service, 1983.

7. Lansing Lamont, Day of Trinity (New York: Atheneum, 1965), pp. 171, 172; Kenneth T. Bainbridge, Trinity (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, May 1976), pp. 16, 17.

8. Day of Trinity, pp. 172-173.

9. HAER drawings of McDonald Ranch, sheets 7, 10, and 11; site investigation by William A. Brenner, Building Technology Inc., February 1983. The balance of the building and structure descriptions in this subsection is drawn from these sources, unless otherwise noted.

10. Schedule of Improvements for Lease and Suspension Agreement, Contract No. DA29-005-Eng-76, dated 29 August 1952; Alamogordo Bombing Range, Tract No. UU-38-2, QQ-38-2, Lease and Suspension Agreement between United States and George and Laura McDonald dated 1 August 1944.

11. Ibid.

12. Lansing Lamont, unpublished papers for Day of Trinity, Tape IX, page 12, Harry S. Truman Library, Independence, Missouri. The damage to the ranch's barn roof is shown clearly in a slide from the slide collection of the Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Washington, D.C.; this slide is reproduced in the supplemental material herein.

GROUND ZERO

Background

The bottom half of a 200 foot Blaw-Knox tower (commonly used by the Army Signal Corps for mounting SCR-271 radar antennas) formed the tower at Ground Zero. Mounted on its footings, the tower was 102 feet high, with a base approximately 25 feet square and a top platform about 15 feet square.[1]

The tower was completed in mid-June 1945, and dry-run tests began in early July. A 10,000 pound block of concrete was used to test the main tower hoist on July 3, and a bomb mockup was lifted to the top of the tower the following day. Practice hook-up tests took place on July 5. A dummy informer unit (a device to distribute signals to the bomb's detonators) was tested on July 6.[2]

On the evening of July 12, the bomb's high explosive assembly was sent by truck from Los Alamos. It arrived at the tower at noon the next day. The assembly was lifted off the truck by the main tower hoist and lowered into a specially prepared cradle around which a tent was erected. A portable hand-powered jib hoist was wheeled over the unit and its polar cap and dummy plug were removed. The bomb's plutonium core, assembled earlier at the McDonald ranch house and delivered to the base of the tower that afternoon, was inserted sometime after 4 p.m. The entire assembly was then rotated and high explosives were packed into the opening left by the dummy plug. Finally, the assembly was righted and the polar cap replaced.[3]

Work on the assembly finished about 10 p.m. and the bomb was left overnight in the tent. Beginning at 8 a.m. the next morning the tent was removed and the bomb slowly hoisted up the tower. After it reached a height of 15 feet, mattresses from base camp were piled up in a criss-cross fashion beneath it to protect the bomb if the hoisting mechanism failed. Special guy wires secured the unit from swaying as it rose. Flooring members from the platform above were removed to make room for the bomb's passage, then replaced after the bomb entered the shed. After being lowered onto the platform deck, the bomb was rotated 90 degrees to simulate the position from which it would be exploded in an aerial drop. Following the bomb's final positioning, explosive detonators were connected around the assembly housing, a dangerous and time-consuming task that was not completed until about 5 p.m.

On the following day, July 15, final tests were run on the circuit controls. Late in the evening, an arming party connected the detonating circuits at the tower, and at 4:45 a.m. the next morning, 45 minutes before detonation, they closed the arming switches at the base of the tower and the firing and signal switches at the firing station at 900 West. This was the last visit to the Ground Zero prior to the test.[5]

Structure Description

The 100 foot high tower was made of bolted steel sections and erected in four 25 foot levels, with every level cross-braced. A guarded steel ladder ran up the northwest corner of the tower and had landings at each 25 foot level. A catwalk at the 75 foot level held tower lighting equipment, and the top platform had a four foot balcony extension on its west side.[6]

Seven foot deep reinforced concrete foundations were poured for each of the four tower legs in late May 1945, and the tower was erected over the next two weeks.[7] The Eichleay Construction Company provided the tower erection crew (the same crew that moved Jumbo and erected its tower).[8] During construction, the foundation anchor bolts were incorrectly placed and offset plates (later covered with concrete) were welded to them, raising the tops of the foundations two feet above grade level.[9]

A corrugated iron shed covered the platform at the top of the tower. From the side of the shed a door opened onto the balcony at the platform's west edge.[10] Both balcony and platform were covered with oak decking and surrounded by a four foot high steel pipe railing. The north side of the shed was left open to allow optical devices at 10,000 North to record the detonation; prior to the test the opening was covered by a tarpaulin. The northwest corner of the platform deck had an access hole to the ladder below and a removable center section through which the bomb was to be hoisted. On a pinnacle above the center of the shed was a hoisting sheave that held a 9/16 inch cable. The cable ran to a 5 ton Shepard-Niles Unit located at the base of the tower. This hoist brought the bomb to the top of the tower.[11]

A 15 foot high gin pole with a 14-foot boom was mounted on the tower's balcony for hoisting light equipment up the tower. The hoist was a 1-1/2 ton electric unit which hung from the tower's lowest chord.[12] Steel cable ran from the hoist through a sheave attached to the 10,000 pound concrete block resting on the ground below the tower. From there it ran up to the gin pole and back to the ground. Historic photographs show the block of concrete still covered by its wood form.[13]

A wood deck at the base of the tower facilitated unloading and handling the bomb. Specifications called for the deck to be 24 feet square and made of 2-inch tongue-and-groove planking.[14]

Copper ground wires ran down each leg of the tower, and a number of co-axial cables were strung from the tower top. Two were connected to ground points at 100 and 200 feet north; the cable at 200 feet north continued in a three foot deep trench to the 10,000 North bunker and served as a signal wire between it and two neutron detectors and a detonator asimultaneity detector located atop the tower.[15] A telephone connected to 10,000 South was located at the base of the tower, as was the switch for the arming circuits in the shed at the tower's top.[16] A standard Army hutment, erected in the vicinity of the tower, was probably used as an on-site office and storehouse[17]

Present remains

Following the detonation, scientific personnel entered the test area in a lead-lined tank to take soil samples with rocket-fired ground scoops. They reported that the area around Ground Zero was covered with a green, glass-like substance, which was later found to be sand and dirt fused by the intense heat of the blast. The scientists gave this material the name "Trinitite."[18]

The explosion left a crater about 1200 feet in diameter and 6 feet deep.[19] The tower was vaporized, leaving only remants of its reinforced concrete foundations, which were apparently driven several feet into the earth by the force of the blast.[20] Sometime after the test, a low shed was built several hundred feet west of Ground Zero to keep intact a portion of the Trinitite, and the remainder of the site was regraded to cover contaminated soil. The shed was rebuilt in 1984; its dimensions, which are probably those of the original, measure about 20 by 50 feet.[21]

Two concentric cyclone fences have been built around Ground Zero. The inner fence is oblong-shaped, with an east-west dimension of 400 feet and a north-south dimension of 200 feet. The outer fence is 1600 feet in diameter.

In 1965, a lava stone monument was erected in the vicinity of Ground Zero to commemorate the Trinity explosion. The obelisk-shaped marker is about 12 feet high and five feet square at the base. A bronze plaque bears the inscription "Trinity Site, Where the World's First Nuclear Device Was Exploded on July 16, 1945. Erected 1965. White Sands Missile Range; J. Frederick Thorlin, Major General, U.S. Army, Commanding." In 1975 a second bronze plaque was added to the monument that declares the Trinity Site a National Historic Landmark.

Notes

1. Trinity memoranda dated 22 June 1945 from Henderson and Carlson to Bainbridge, and 19 June 1945 from Bainbridge, Record Group A-84-019, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico; and Trinity Site photographs TR-386B and 783, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico.

2. Trinity memorandum dated 11 June 1945 from Bainbridge about meeting of 9 June with Bradbury, Keiller, Greison, Hornig, Holoway, DeWire, Mack, and Wilson.

3. Lansing Lamont, Day of Trinity (New York: Atheneum, 1965), pp. 168-173; Kenneth T. Bainbridge, Trinity, (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, May 1976), pp. 40-43.

4. Day of Trinity, pp. 174, 175.

5. Ibid., pp. 218, 219; unpublished oral interview by Edwin C. Bearss, National Park Service, with Bob Krohn, Berlyn Brixner, John Manley, and Joe McKibbon at Trinity Site, June 1968, pp. 15, 16.

6. Trinity memorandum dated 17 March 1945; Trinity Site photographs TR-226, 298, 386B, and 783.

7. Trinity memorandum dated 15 June 1945 from Bainbridge.

8. Trinity memorandum dated 25 May 1945 from Williams to Bainbridge.

9. Trinity memorandum dated 22 June 1945 from Henderson and Carlson to Bainbridge; Trinity Site photogaph TR-310.

10. Trinity memorandum dated 15 June 1945 from Bainbridge.

11. Trinity memoranda dated 22 June 1945 from Henderson and Carlson to Bainbridge, 17 March 1945 from Bainbridge to Mitchell, 1 June 1945 from Bainbridge to Kistiakowsky, 15 June 1945 from Bainbridge, 11 June 1945 from Bainbridge about meeting of 9 June, and undated tower construction schedule; Trinity Site photographs TR-226, 298, 386B, and 783.

12. Trinity memorandum, undated tower construction schedule.

13. Trinity Site photograph TR-310.

14. Trinity memorandum dated 19 May 1945 from Bainbridge to Henderson; Trinity Site photograph TR-310.

15. Trinity memoranda dated 24 April 1945 from Bainbridge to Williams and 12 June 1945 from DeWire to Keiller.

16. Trinity memorandum dated 15 June 1945 from Bainbridge.

17. Trinity memorandum dated 30 April 1945 from Williams to Davalos.

18. Los Alamos Scientific Laboratory, Los Alamos: Beginning of an Era, 1943-1945 (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, n.d.), p. 55; Day of Trinity, p. 246; Bearss interview, pp. 31, 32; Trinity Site photograph TR-392A.

19. Groves, Leslie R., Now It Can Be Told: The Story of the Manhattan Project (London: Andre Deutsch, 1963), p. 433. Estimates of the crater size vary among different accounts. This estimate was the one sent to Secretary of War Stimson on July 18, 1945 by Groves. All estimates agree that the crater was very broad and quite shallow.

20. Bearss interview, p. 31; unnumbered Los Alamos photograph showing General Groves, Oppenheimer, and others at crater. This visit took place on September 9, 1945 according to Ferenc Morton Szasz, The Day the Sun Rose Twice: The Story of the Trinity Site Nuclear Explosion, July 16, 1945 (Albuquerque, New Mexico: University of New Mexico Press, 1984), p. 160. The remains of the tower's foundation are shown in a photograph from the slide collection of the Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Washington, D.C.; the slide is reproduced in the supplemental material herein.

21. Site investigation by Robie Lange, Historic American Buildings Survey/ Historic American Engineering Record, National Park Service, November 1984.

INSTRUMENTATION AND OBSERVATION FACILITIES

Background

Between December 1944 and July 1945, an elaborate network of test instrumentation, observation, and control facilities was built in the desert within a 10,000 yard radius of Ground Zero (see HAER measured drawings NM-1A, Sheet 3). These included a control and personnel bunker at 10,000 yards South, personnel and camera bunkers at 10,000 yards North and West, and instrumentation bunkers at 1000 and 800 yards North, 400 yards Northwest, and 800 yards West, as well as hundreds of gauges and other field test devices. The bunkers were connected by 22 miles of new roads, and the test site itself was bisected by another 25 miles of upgraded roads. In addition, the road from Ground Zero to 10,000 West was extended 28 miles west to the railroad siding at Pope, New Mexico. Nearly 500 miles of communications and signal cables linked the bunker and instrumentation sites, with all signal lines closer than 3000 yards from Ground Zero laid in underground trenches.[1]

The test equipment used at Trinity Site collected information on the physical behavior of the implosion device; the nuclear, air blast, and earth shock energy released by the bomb; the bomb's incendiary effects; and phenomenon of the explosion itself. The means for gathering this data were as follows:[2]

- The physical behavior of the implosion was to be determined by 1) recording, through electronic signals sent to fast oscilloscopes at 10,000 South, the simultaneity of the detonators as they exploded; 2) measuring the interval between the firing of the detonators and the first gamma rays emitted from explosion; and 3) gauging the rate at which fissions occurred by use of electron multiplier chambers and a direct deflection high-speed oscillograph.

- The energy released from the atomic reaction was to be gauged by 1) recording delayed gamma rays in 16 ground and airborne (via weather balloons) ionization chambers, with information transmitted to Heiland recorders at the three 10,000 yard bunkers, as well as with two tank-mounted ionization chambers to be taken to Ground Zero after the blast; 2) measuring delayed neutrons by the use of cellophane catcher cameras at two ground and one airborne stations, and by the use of 8 sulphur threshold detectors and a number of gold foil detectors; and 3) measuring the conversion of plutonium-239 fission products from post-test ground and air samples to be analyzed radiochemically for alpha, beta, gamma, and gross particle counts and submitted to plutonium-239 and fission product chemistry. Ground samples were to be taken from the crater area and air samples were to be taken from above the test site by a specially equipped B-29.

- The air blast from the bomb was to be determined by 1) gauging blast pressure near Ground Zero with 22 quartz Piezo gauges, supplemented by 8 condenser gauges on the ground and 6 condenser gauges to be dropped from planes; 2) measuring blast velocity with 10 moving-coil loudspeaker pickups suspended several feet above grade, and with blast-operated torpex flash bombs whose explosions were recorded photographically; 3) measuring peak pressure with 20 spring loaded piston gauges at 367, 500, 567, 1000, 1500, and 2000 yards from Ground Zero, a number of crusher gauges located very close to Ground Zero, and 52 aluminum diaphragm box gauges located radially from Ground Zero; 4) measuring remote pressure with Friez ML-3-A bargraphs in 15 surrounding towns; 5) measuring blast impulse with 12 mechanically recording piston liquid and orifice gauges at 307, 500, 567, 1000, 1500, and 2000 yards from Ground Zero; and 6) measuring mass velocity and shock wave expansion by photographically recording the ignition of suspended primacord and magnesium flash powder near the tower with Fastax cameras at 800 North and West.

- The earth shock created by the bomb was to be measured by 1) determining close-in ground movement with 12 velocity type, moving coil, strong motion geophones placed at 800, 1500, and 9000 yards north and south of Ground Zero; 2) recording distant ground movement with 5 Leet three-component, strong motion displacement seismographs at 9000 yards north and at the neighboring towns of Elephant Butte, San Antonio, Tularosa, and Carrizozo, New Mexico; 3) gauging permanent horizontal and vertical earth displacement by the use of steel stakes placed around Ground Zero; and 4) recording distant tremors by remote seismographs at Tuscon, El Paso, and Denver.

- The bomb's incendiary effects were to be tested by evaluating the burning or charring of roofing materials, wood, and excelsior placed on stakes at varying distances from Ground Zero.

- Finally, the phenomenon of the explosion itself was to be recorded by 1) photographing the behavior of the fireball with six 8000 frames-per-second Fastax cameras, two 4000 fps Fastaxes, and two 800 fps Fastaxes, approximately 30 standard 16 mm color cameras, and a 16 mm Cline-Special 24 fps camera; 2) tracking the fireball on two SCR-584 radar sets; 3) photographing the rise of the smoke column with four 100 fps and one 24 fps Mitchell 35 mm motion picture cameras, two pinhole cameras, and two gamma ray recorders; 4) photographing the lateral movement of the cloud with Fairchild 9"x9" Aero View cameras; and 5) using two Hilger high-time-resolution spectrographs, two Bausch & Lomb spectrographs, and a recombination spectrograph for spectrographic measurements, two thermocouples with recording equipment for measuring total radiation, and six photocells recording on drum oscillographs for photometric measurements.

Many of these test instruments and related measuring devices were left exposed above ground. Others were placed in small makeshift shelters of wood or steel which were buried or otherwise protected by mounded earth. Four relatively large reinforced concrete instrument bunkers were constructed at 800 North and West, 1000 North, and 600 Northwest.

Structural Description of the 800 North and West Instrument Bunkers

The 800 North and West instrument bunkers were identical in design and nearly identical in construction. The interior of each measured 6'-0" by 6'-0" by 6'-7" high. Three small viewing ports on the bunkers' front wall were shielded by protective concrete pipes approximately 16 inches in diameter and 8 feet long, open on their far end to provide a protected view of the tower at Ground Zero. A fourth viewing port was located on the right side wall. All four viewing ports were covered with bullet-proof glass.[3]

The bunkers, which were half buried, were covered with 2 feet of earth fill topped by an angled 12 inch thick concrete slab. Made completely of reinforced concrete, the structures had 6 inch thick walls and floors and a 12 inch thick ceiling. A door at the rear of each bunker measured 30" wide and 36" deep. The exterior entrance to the shelter door at 800 West was protected by low timber retaining walls, and both bunkers had protective timber wing walls to the left of their doors and along their right front sides. These wing walls were anchored to buried log deadmen by steel tie rods. Historic photographs show the wing walls to have been completely covered with earth before the test.[4]

The bunkers' interior wooden form work was not removed, allowing wiring and equipment to be fastened to walls and ceilings. The doors to both structures were made of wood. A capped metal pipe, about 4 inches in diameter and 8 inches high, projected from the roof of each bunker.[5]

Both bunkers were built to contain high speed Fastax cameras for recording the first milliseconds of the blast. Sometime prior to the main test in July 1945—probably after the 100-ton test on May 7—a decision was made to put the Fastax cameras on lead-lined steel sleds. Historic photographs show the sleds to be about 4 feet wide by 6 feet long and attached to steel cables. The cables are reported to have been 1000 or more feet long, and were used to tow the sleds away from Ground Zero to a point where the film in the Fastax cameras could be safely removed. The cameras themselves faced upward toward small mirrors attached at 45 degree angles to the tops of their shielded containers. The sleds were parked adjacent to the 800 yard bunkers on what appears to be a concrete pad.[6]

The 800 North and West bunkers were designed at Los Alamos between August and November 1944, and are designated as Building Number 1 on the four bunker construction drawings (see supplemental material, construction drawings). Construction began in December 1944 and the bunkers were completed by the

following April. It is unclear what, if any, equipment was finally located at 800 North for the test. A recording mechanism, possibly a set of electron multiplier chambers for measuring implosion characteristics, is known to have been sheltered at 800 West.[7]

Structural Description of the 1000 North and 600 Northwest Instrument Bunkers

No drawings exist for the 1000 North or the 600 Northwest bunkers. They were about the same size as the 800 North and West bunkers, and were made of reinforced concrete and covered with earth fill (although unlike the 800 structures, the fill was not topped by a concrete slab). Both were built in June 1945, suggesting that they were afterthoughts, possibly the result of findings from the May 7th 100-ton test. Neither structure had viewing ports, but the 600 Northwest bunker had two 5-inch diameter metal pipe vents projecting about 18 inches above a rectangular concrete base that projected from the structure's roof. The 1000 North bunker had a small metal pipe, about 1-1/2 inches in diameter and 18 inches long, projecting from its roof. Each bunker had a door opening that faced away from Ground Zero. The door to 600 Northwest was below grade, with an exterior earth and wood stair flanked by timber retaining walls leading down to it.[8]

Historic photographs show a wood addition, framed in heavy timber and measuring about 10 feet square, attached to the rear of the 1000 North bunker. The addition was covered with asphalt-impregnated roofing felt (tarpaper) and had a door on the right side of its rear wall. A small amount of earthen fill was placed over the roof of the addition prior to the test. Records indicate that the addition had a crude air conditioner to keep instruments cool, and that the interior of the adjacent concrete shelter had a labyrinthian entrance designed to shield its enclosed instruments from stray neutrons produced by the blast. A large copper signal cable ran underground from the tower at Ground Zero to the bunker. Several yards north were two unenclosed motor generator sets that provided power to the site.[9]

Records are vague about the uses of the 1000 North and the 600 Northwest bunkers, but it appears that both had radiation-measuring equipment of various kinds for gathering information about the implosion. It is known that a cellophane catcher camera for measuring delayed neutrons was sheltered in the 600 Northwest bunker.[10]

Structural Description of the Firing Station at 900 West

A small firing station was located at a point 900 yards west of Ground Zero that contained the firing and timing switches for the signal cables running from 10,000 South to the bomb tower and to nearby field instruments. The station was apparently made of wood and built on or just above ground level.[11]

Structural Description of the 10,000 North, West, and South Personnel Bunkers

Most of the on-site test instruments were designed to relay information via cable or FM transmitter to recording equipment at one or more of the three large personnel bunkers at 10,000 North, West, and South. Work on these bunkers, which were all of similar design and construction, began in December 1944 and was completed by early March 1945. The structures were built on grade level. They were supported by heavy timber framing and had interiors 15 feet deep, 25 feet wide, and 7 feet high.[12]

Each bunker had floors of one inch tongue-and-groove wood decking covered by linoleum, and three of its walls and its ceiling were made of timber sheathing covered by roofing felt mopped with asphalt. This assembly was protected with earth fill to a depth of five feet over the ceiling. The fourth wall of each bunker, which faced opposite the direction of Ground Zero, was also sheathed and covered by roofing felt, but was left exposed to the exterior, protected by timber retaining walls above and to each side. Sometime after the bunkers' construction, timber braces were placed diagonally against the outside of these walls to counteract the thrust of the earth fill above them. A pair of 2'-6" by 6'-3" doors in the walls' center served as the entrance to each of the bunkers. Interior walls and exterior retaining walls were anchored to buried log deadmen by steel tie rods. Flat, twelve inch thick concrete slabs, 21'-0" long and 25'-4" wide, were poured over the earth fill atop each bunker.[13]

Once construction was completed, the personnel bunkers were outfitted with projection periscopes, the rectangular shafts of which ran up the outside of the bunkers' one exterior wall and ended in a 45 degree point above the top of the structure. The periscopes were designed to project an image of the explosion on a screen inside the bunkers. A public address system, 3-phase 120/140 volt power, electric lighting, telephones, and a host of recording and timing instruments were also added to the bunkers. The 10,000 South bunker, which served as the control bunker where all timing signals and the firing signal originated, was divided into sections housing equipment for implosion time, velocity, air blast, shock wave, and gamma ray measurements. There were also spaces for housing the site's main timing and firing controls and its central communications equipment.[14]

The 10,000 West personnel bunker had space allocated for camera timing and for air blast, shock wave, and velocity measuring equipment, while space at 10,000 North was assigned to implosion time and gamma ray measuring equipment, camera timing equipment, and condenser gauge recording apparatus and its associated FM radio receiving equipment.[15]

The 10,000 yard personnel bunkers were designed at Los Alamos between August and November 1944, and are designated as Building Number 2 on the four bunker construction drawings (see supplemental material, construction drawings).

Structural Description of the 10,000 North, West, and South Generator Bunkers

Near each of the personnel bunkers at 10,000 North, West, and South stood a generator bunker. All three, similar in design and construction, housed the M-7 motor generator sets that provided power to each site and its sector of field instruments and equipment. The bunkers were built at grade level with interiors 11 feet wide, 16 feet long, and 10 feet high. Both ends of the structure were open, and only the wall facing Ground Zero was covered with earth fill. The fill was held in place by timber retaining walls. An exposed 2'-6" deep concrete slab, 16 feet long and 13'-6" wide, was poured directly over the bunkers' flat wood ceiling, with no intermediate layer of earth fill. Structural and waterproofing details were generally similar to those for the personnel bunkers. The wood formwork for the top slab was left on the bunker at 10,000 West.[16]

Historic photographs show wood frame additions on the 10,000 South and West generator bunkers, and it is likely that the bunker at 10,000 North had a similar one. Added to the rear (side away from Ground Zero) of the bunkers, the additions were put up sometime after the bunkers were built, probably to house power control equipment. They had pitched roofs and measured 16 feet by about 12 feet, with a window in their rear and right walls and a large opening, covered with double, vertically hinged garage doors, on their left wall. Walls and roofs were protected by exposed roofing felt.[17]

The generator bunkers were designed at Los Alamos between August and November 1944, and are designated as Building Number 3 on the four bunker construction drawings (see supplemental material, construction drawings). The drawings do not show the wood frame additions. All three generator bunkers were apparently built about the same time as the personnel bunkers, although the 10,000 West bunker may have been built several months later.

Structural Description of the 10,000 North and West Camera Bunkers

Identical reinforced concrete camera bunkers were located close to the personnel shelters at 10,000 North and West. These structures, which were built on grade, had interior dimensions 10'-6" by 10'-6" by 7 feet high. Three of the bunkers' four walls were 8 inches thick, the floor was 4 inches thick, and the flat roof, which overhung the front (facing Ground Zero) of the bunker by 3 feet, was 2'-9" thick. Five camera portholes, fitted with bullet-proof glass, were located on the front wall. The rear bunker wall was the only portion of the structure not of reinforced concrete; it was made of wood sheathing over 2x4 framing and had a 3 foot wide door approximately in its middle. Wood formwork, left in place on the bunker interiors, allowed equipment and circuitry to be fastened to walls and ceilings.[18]

Five foot deep wood frame additions extended from the rear of the camera bunkers, and a rotating machine gun turret was installed through a 45 inch diameter opening in the roof of each. The turrets weighed 950 pounds apiece, and steel reinforcing angles were later added to the additions for supplemental support. Roofing felt was applied to the exterior of the additions for weather protection. A 3 foot wide door provided entry from the rear.[19]

The camera bunkers were supplied with electric power, a public address system connected to the personnel bunkers, lighting, and a telephone. By the time of the test, they were crammed with instruments. A large assortment of recording devices was installed in these bunkers or—it is unclear how much—in their adjacent personnel shelters, including a Fairchild 9"x9" Aero View camera, a pinhole camera, a large Mitchell 35 mm motion picture camera, a color-temperature camera, a fast and slow Fastax camera, approximately 16 standard 16 mm color motion picture cameras equipped with various lenses and filters, a Hilger high-time-resolution spectrograph and a Bausch & Lomb spectrograph, a recombination spectrograph, a gamma ray recorder, and a thermocouple with recording equipment. Additionally, a drum camera was located at 10,000 West. Most if not all of the motion picture cameras were mounted on the camera bunkers' roofs. All recording devices were wired to operate automatically from signals carried by a large coaxial cable from the 10,000 South bunker.[20]

The 10,000 North and West camera bunkers were designed at Los Alamos between August and November 1944, and are designated Building Number 4 on the four bunker construction drawings (see supplemental material, construction drawings). They were built about the same time as the personnel bunkers.

Description of Miscellaneous Structures

A standard Army hutment was situated at each of the three 10,000 yard complexes, and SCR-584 radar sets, which were to be used to track the fireball, were located at 10,000 South and West. The radar sets each consisted of an antenna mounted on an equipment trailer, and were probably protected by earthen revetments. Searchlights, to be focused on the tower at Ground Zero, were mounted on or near the personnel bunkers at 10,000 North and West. An elevated tank about 4 feet in diameter stood just south of the personnel bunker at 10,000 South. It is likely that the tank held drinking water.[21]

Five explosives storage magazines were constructed two miles south of Ground Zero, 800 feet off the road to 10,000 South. There is no record of how or of what materials the magazines were constructed, but the largest, finished sometime in June, measured 10 feet wide, 19-1/2 feet long, and 6 feet high with double 3'-0" by 6'-8" doors. It was scheduled to hold 6000 pounds of explosive charges. A second magazine measured 6 by 6 by 6 feet and contained Pentolite cups and boxes, tetryl pellets, Composition B explosive charges,

and primacord. A third magazine was used for storing explosive caps and measured 2 by 2 by 2 feet. The fourth and fifth magazines contained signal rockets, probably for use during the July 16 test.[22]

Present remains

There is little evidence of the vast instrumentation, observation, and control network that briefly covered the test site in the summer of 1945. The personnel and generator bunkers were razed as safety hazards many years after the war and nothing is left of them except fragments of their concrete slabs. The reinforced concrete camera bunkers at 10,000 North and West are completely intact, but stripped clean of their wood frame additions, wood interiors, wiring, and every other assembly or device they once held (see HAER photographs Nos. NM-1A-70 through NM-1A-73). It is only the presence of the camera bunkers that indicates where the 10,000 North and West sites once stood; the 10,000 South site has no readily visible landmarks whatsoever.[23]

The reinforced concrete bunkers 1000 North, 600 Northwest, and 800 North and West are also intact, but they too have been stripped of all accessories (see HAER photographs Nos. NM-1A-74 through NM-1A-85). Much of the earth around the bunkers was scoured away by the blast, and has eroded further since. The wood frame addition at 1000 North is completely gone.[24]

The remains of the small firing station at 900 North were located during a site investigation in 1968 and may still exist. Remains of the explosives storage magazines may also exist. Myriad wires can be found crisscrossing the desert in the test area, in some locations still fastened to ceramic insulators on wood ties (see HAER photograph No. NM-1A-86). It is likely that many small instrument stations lie unnoticed or hidden beneath the sand in the 30 or more square miles encompassed by the test site, although in the intervening forty years some may have been destroyed by the weather, vandalism, or military testing activities.[25]

Notes

1. Lansing Lamont, Day of Trinity (New York: Atheneum, 1965), pp. 120-123, 141; Kenneth T. Bainbridge, Trinity, (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, May 1976), p. 27; Los Alamos Scientific Laboratory, Los Alamos: Beginning of an Era, 1943-1945 (Los Alamos, New Mexico: Los Alamos Scientific Laboratory, n.d.), p. 34; Stephane Groueff, Manhattan Project: The Untold Story of the Making of the Atomic Bomb (Boston: Little, Brown and Company, 1967), pp. 341-345; unpublished oral interview by Edwin C. Bearss, National Park Service, with Bob Krohn, Berlyn Brixner, John Manley, and Joe McKibben at Trinity Site, June 1968, general description of instrumentation throughout

text; Trinity memorandum dated 7 December 1944 from Davolos to file, Record Group A-84-019, Los Alamos National Laboratory Records Center/ Archives, Los Alamos, New Mexico; Trinity Site photographs TR-213, 248, 250-253, 258, 259, 264, 265, 296, 329, 372C, 406, 416, and 418, Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico.

2. Trinity, pp. 9-13.

3. Trinity construction drawings for "Building No. 2," Los Alamos National Laboratory Records Center/Archives, Los Alamos, New Mexico.

4. Ibid., for "Building No. 1;" Trinity Site photographs TR-235, 287, 302, 342-344, 346, 347, 364-366, and 388 for 800 West, and TR-43, 44, 202, 331, 417, 424, and 432 for 800 North.

5. Trinity construction drawings for "Building No. 1."

6. Bearss interview, p. 14; Trinity Site photograph TR-782.

7. Trinity memorandum dated 7 December 1944 from Davalos to file; Trinity, p. 53.

8. Trinity memorandum dated 25 May 1945 from Williams to Keiller; Trinity Site photographs TR-219, 315, and 328 for 600 Northwest and TR-217, 228, 286, 301, 304-307, 341, 345, 354, 409, and 411 for 1000 North; site inspection by William A. Brenner, Building Technology, Inc., April 1984.

9. Trinity Site photographs TR-409, 411, and 228; Bearss interview, pp. 17, 18.

10. Trinity, pp. 53, 54.

11. Day of Trinity, p. 219.

12. Trinity construction drawings for "Building No. 2;" Trinity Site photographs TR-45, 201, 268, 397-400, 410, 421, 425, and 779 for 10,000 North, TR-3, 4, 291, 316, 369C, 370, 407, 426, 427, 429, 771, 778, 797, and 798 for 10,000 South, and TR-5, 7, 396A-C, 419, 420, 423, 796, and 800 for 10,000 West.

13. Ibid.

14. Bearss interview, p. 6; Trinity memorandum dated 21 April 1945 from Williams to Mack, 12 June 1945 from Williams, 18 April 1945 and 24 April 1945 from Graves to Williams, and associated drawing dated 28 May 1945 for field telephone system.

15. Trinity memorandum dated 12 June 1945 from Williams.

16. Trinity construction drawings for "Building No. 3;" Trinity Site photographs TR-291, 316, 426, 429, and 771; Trinity memorandum dated 24 April 1945 from Williams to Davalos.

17. Ibid.

18. Trinity construction drawings for "Building No. 4;" Trinity Site photographs TR-5, 7, 45, 396A, 396B, and 397 through 400.

19. Trinity memoranda dated 16 April 1945 and 21 April 19435 from Mack to Williams; Trinity Site photographs 45, 201, 396B, and 398 through 400.

20. Trinity, pp. 45-69.

21. Trinity memorandum dated 7 March 1945 from Williams to Davalos; Day of Trinity, p. 219; Trinity Site photographs TR-407 and 426; Bearss interview, p. 42.

22. Trinity memoranda dated 7 June 1945 from Bainbridge to Bradbury and 7 June 1945 from Bainbridge to Steward.

23. Site investigation by Brenner of April 1984.

24. Ibid; Bearss interview, p. 15.

25. Ibid.

SOURCES OF INFORMATION

Original Construction Drawings

The only construction drawings that exist are listed in the supplemental material section, below, with copies appended herein. An assortment of site layout sketches are included with the Trinity Site memoranda listed in the bibliography, below, under Los Alamos, New Mexico.

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Smyth, Henry DeWolf. Atomic Energy for Military Purposes: The Official Report on the Development of the Atomic Bomb under the Auspices of the United States Government. Princeton, New Jersey: Princeton University Press, 1946.

Historic Photographs

Los Alamos, New Mexico. Los Alamos National Laboratory Records Center/ Archives. Historic photographs of Trinity Site, 1945. This collection contains over 800 photographs, 123 of which are reproduced in the supplemental material below.

Washington, D.C. Historic American Buildings Survey/Historic American Engineering Record, National Park Service. Two unnumbered photographs from the HABS/HAER slide collection. These photographs are reproduced in the supplemental material below.

Supplemental Material

Construction drawings, for 800 North and West instrumentation bunkers ("Building No. 1"); 10,000 North, West, and South personnel bunkers ("Building No. 2"); 10,000 North, West, and South generator bunkers ("Building No. 3"); and 10,000 North and West camera bunkers ("Building No. 4"). Four sheets total. Dated November 1, 1944. Record Group A-84-019, Los Alamos, National Records Center/Archives, Los Alamos, New Mexico.

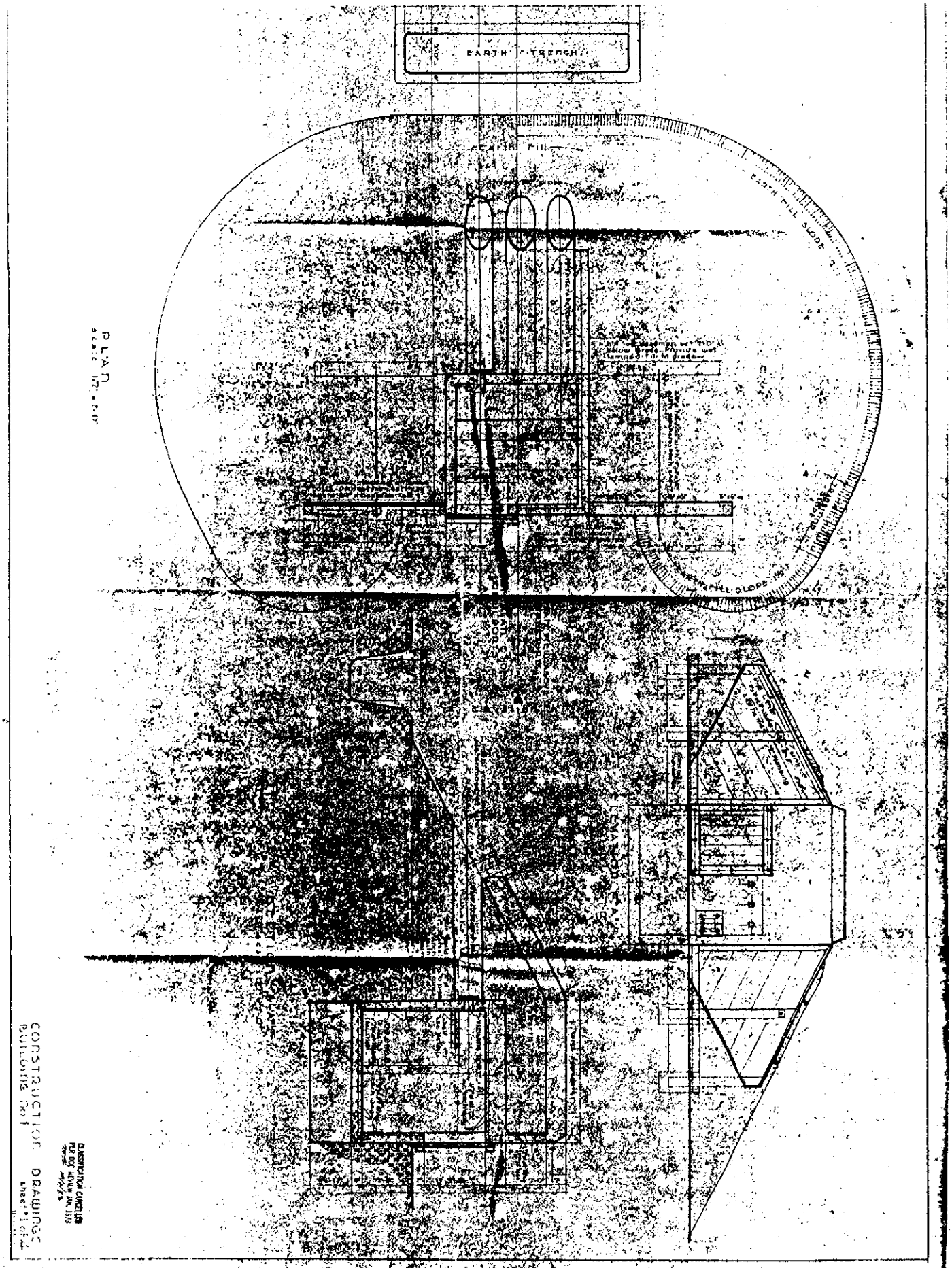
Copies of 122 photographs taken at Trinity Site in 1945. Los Alamos Record Center/Archives, Los Alamos, New Mexico.

Copies of two slides taken at Trinity Site in 1945. Slide collection, Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Washington, D.C.

Prepared by: William A. Brenner, AIA
Building Technology Incorporated
November 1985

PROJECT INFORMATION

This project was part of a program initiated through a memorandum of agreement between the National Park Service and the U.S. Department of the Army. Stanley H. Fried, Chief, Real Estate Branch of Headquarters DARCOM, and Dr. Robert J. Kapsch, Chief of the Historic American Buildings Survey/ Historic American Engineering Record, were program directors. Sally Kress Tompkins of HABS/HAER was program manager, and Robie S. Lange of HABS/HAER was project manager. Under the direction of William A. Brenner, Building Technology Incorporated, Silver Spring, Maryland, acted as primary contractor, and MacDonald and Mack Partnership, Minneapolis, was a major subcontractor. This project included a survey of historic properties at White Sands Missile Range, as well as preparation of an historic properties report and HAER documentation for Trinity Site and the McDonald Ranch. Written documentation was completed by William A. Brenner, Building Technology Incorporated, and reviewed by Dr. Larry D. Lankton. Photographs were taken by Frank Ontiverous, Bob Halferty, and Dick Brown of the White Sands Missile Range Photographic Laboratory. Measured drawings were produced by Rosanna H. Santos and Marian Dombroski.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EARTH FILL
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PLAN
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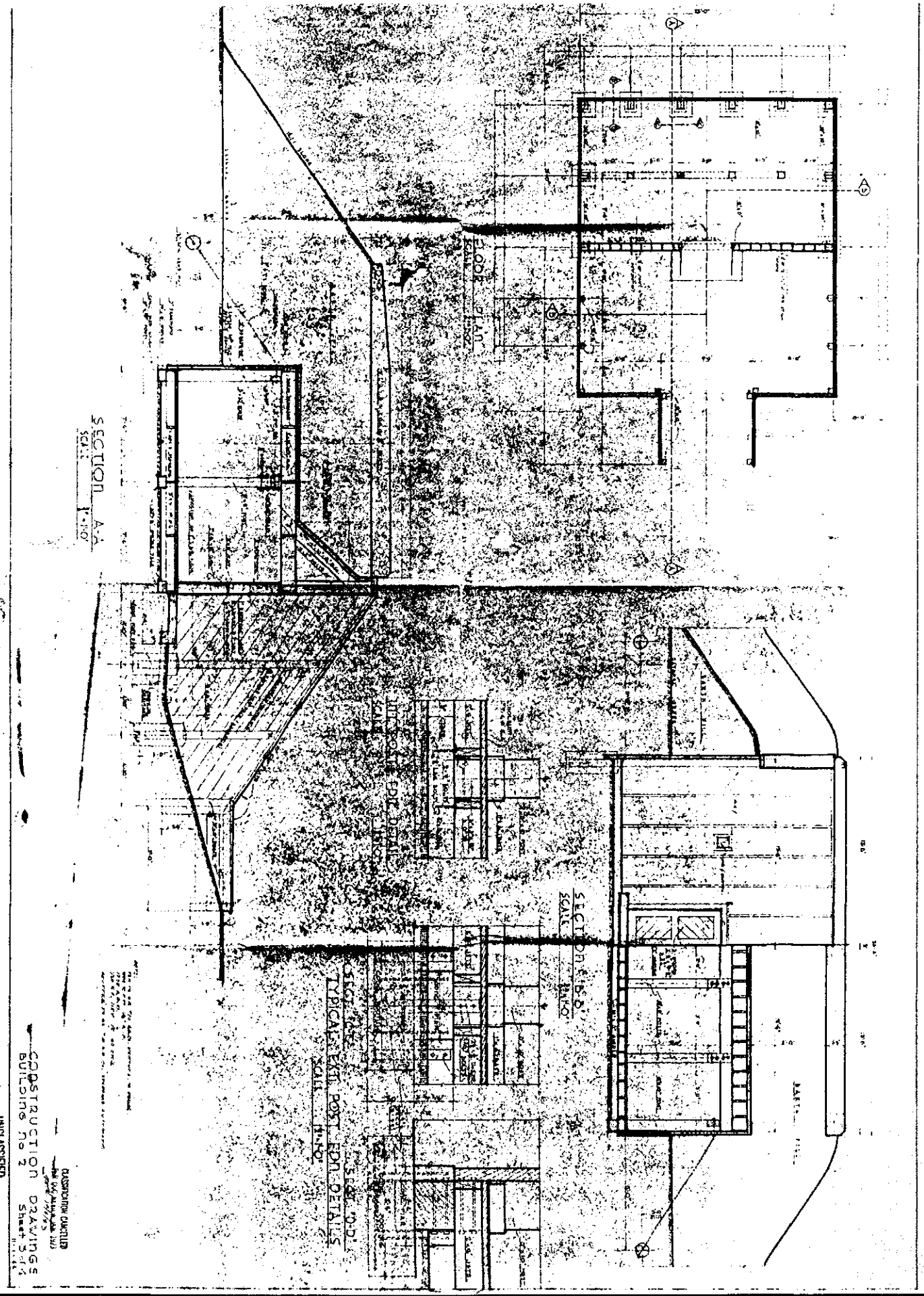
Building No. 1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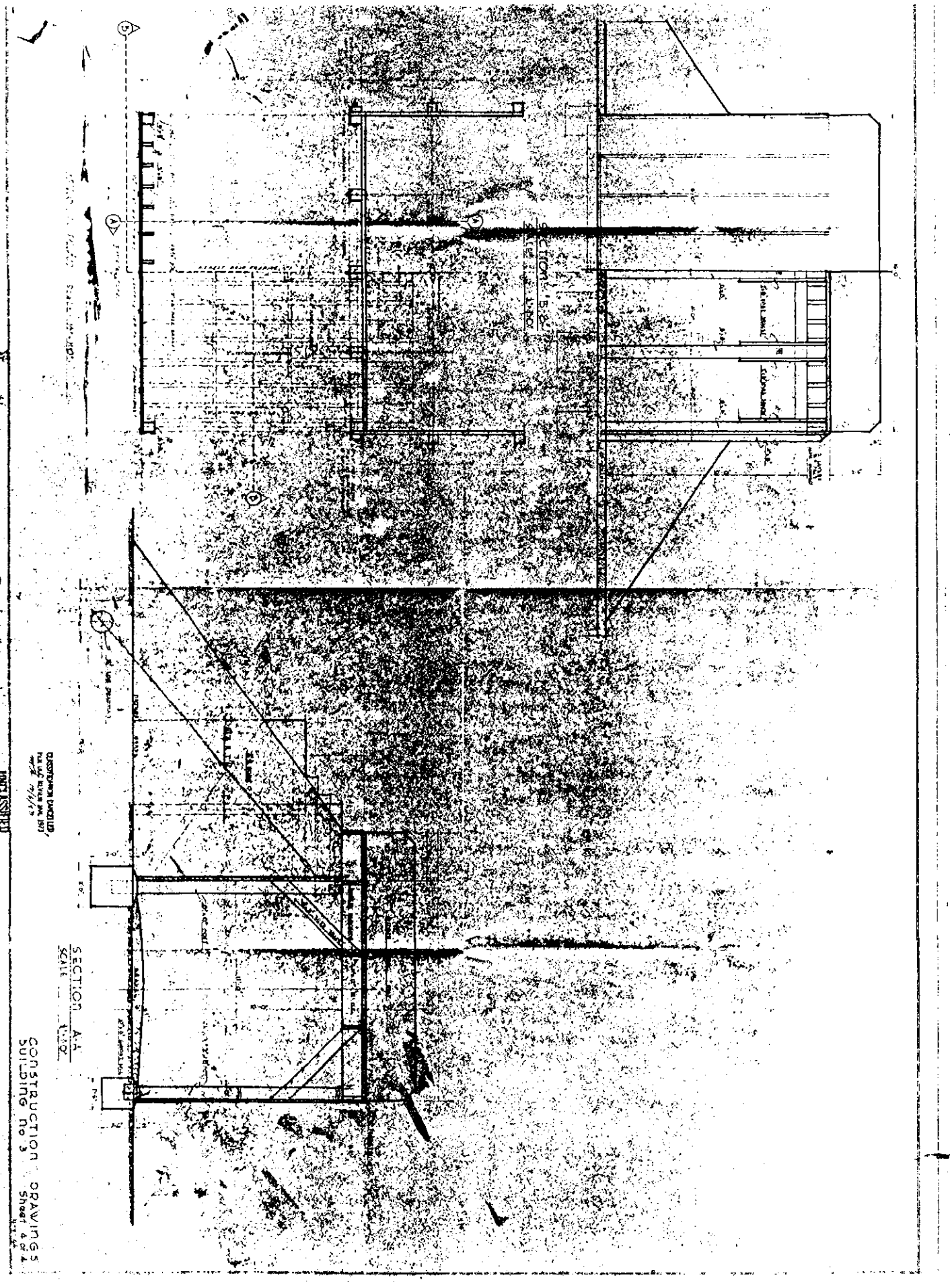
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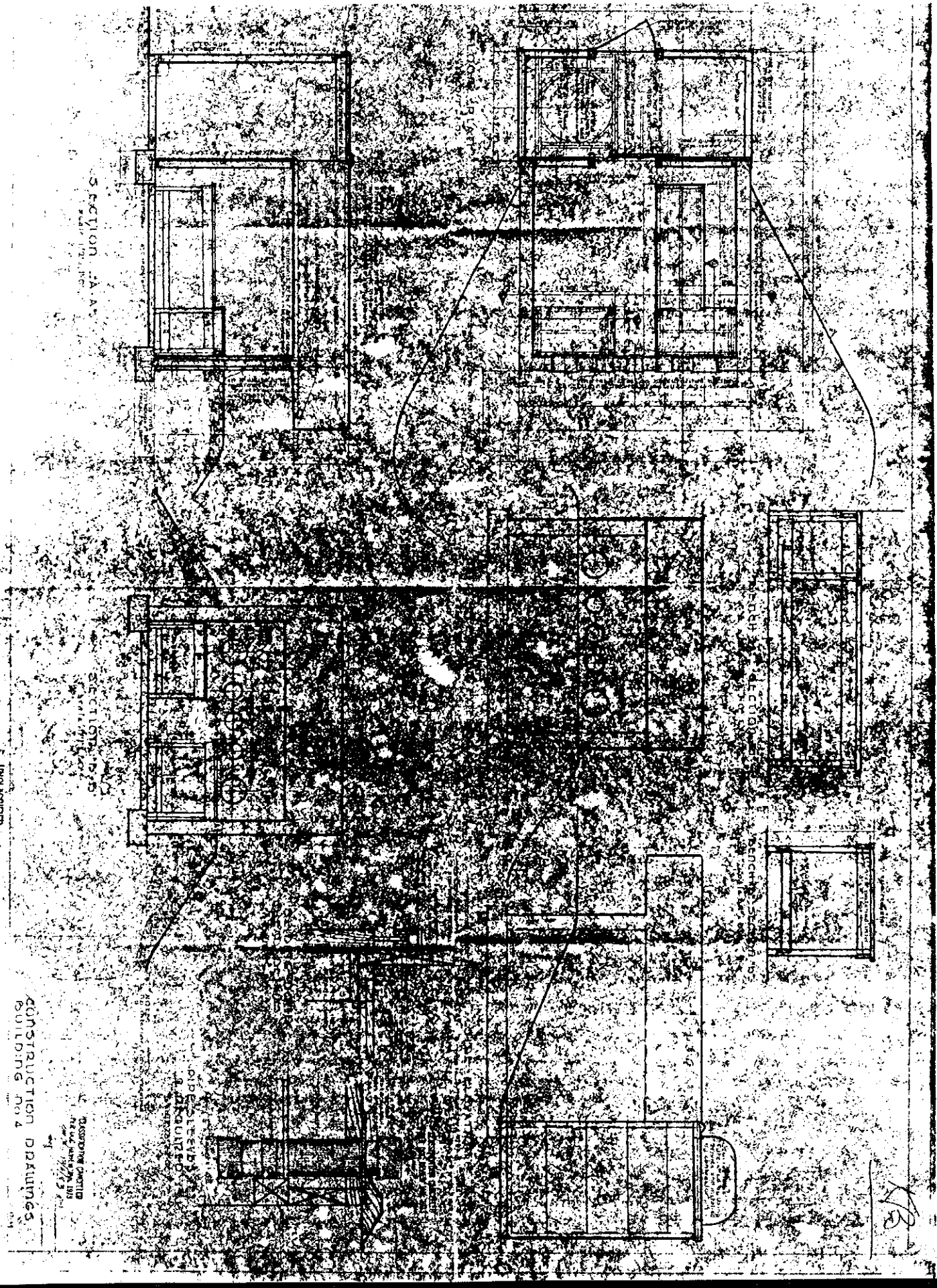
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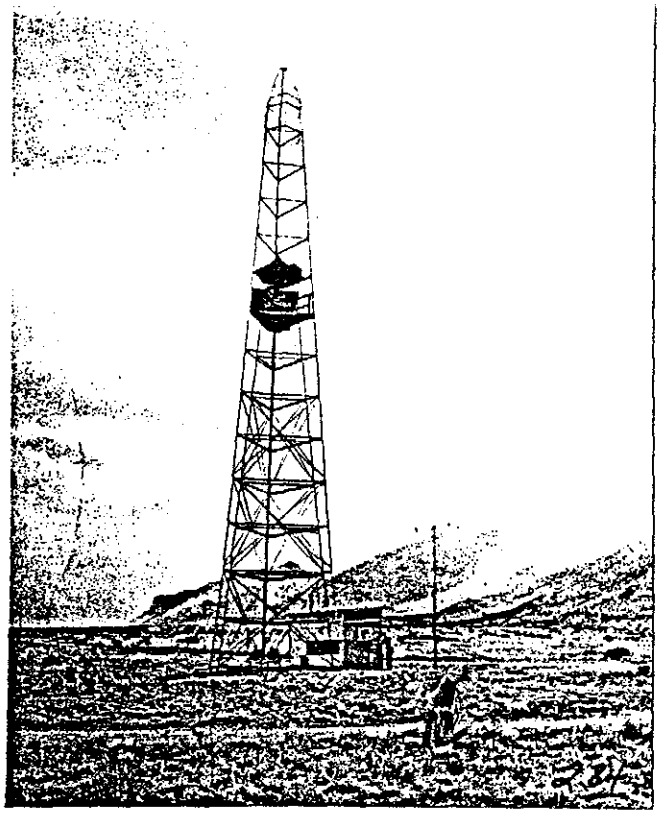
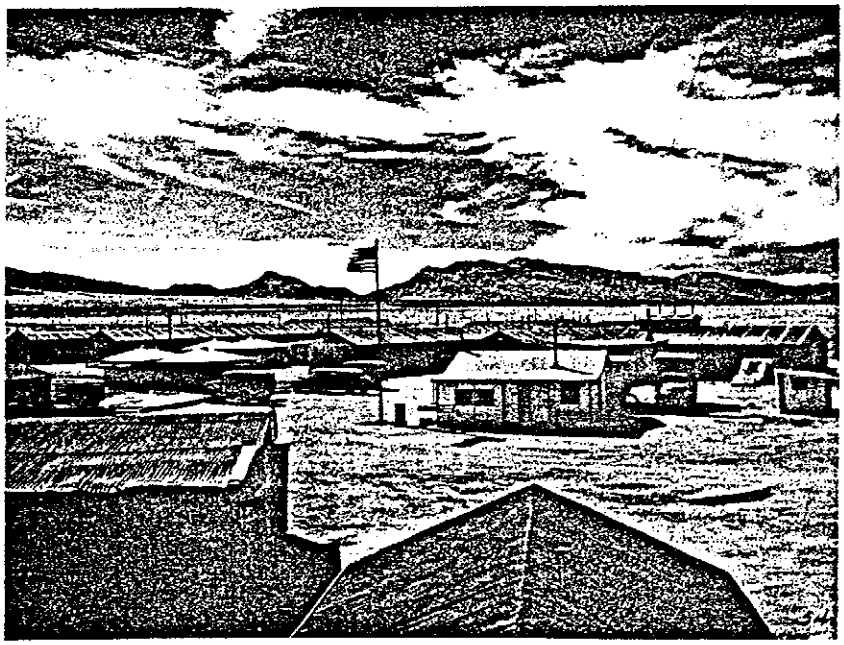
CONSTRUCTION DRAWINGS
BUILDING NO 4

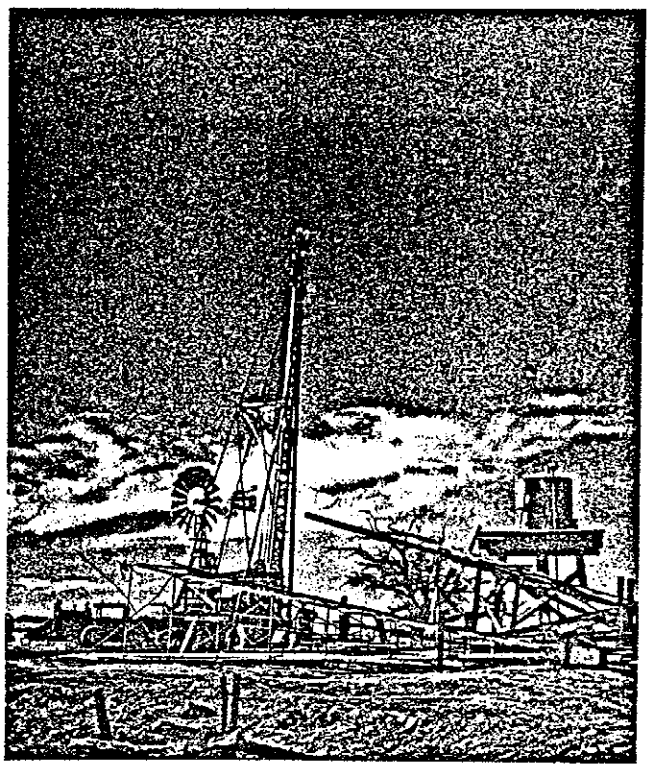
The following are copies of 122 photographs taken at Trinity Site in 1945 and stored at the Los Alamos Records Center/ Archives, Los Alamos, New Mexico. The photographs are arranged in the order that they are listed in the text notes herein, with Los Alamos photo numbers shown first, text section heading second, and original photo caption in quotations.



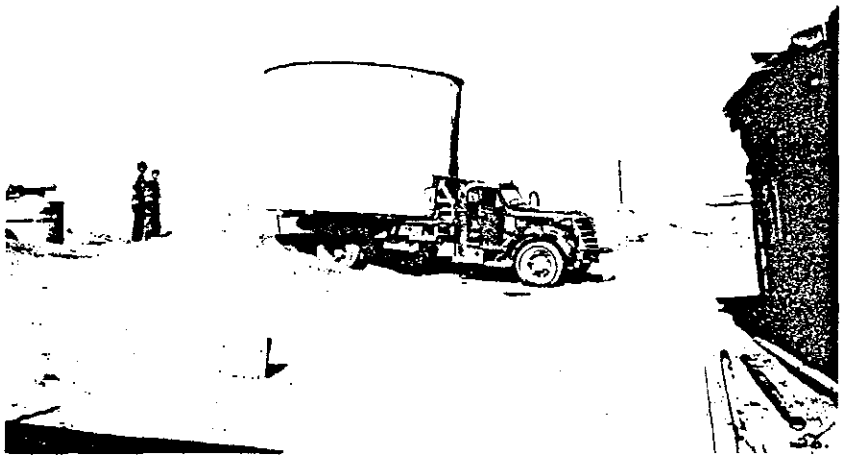
TR-284 Trinity Site and the Trinity Test "Guard Post."



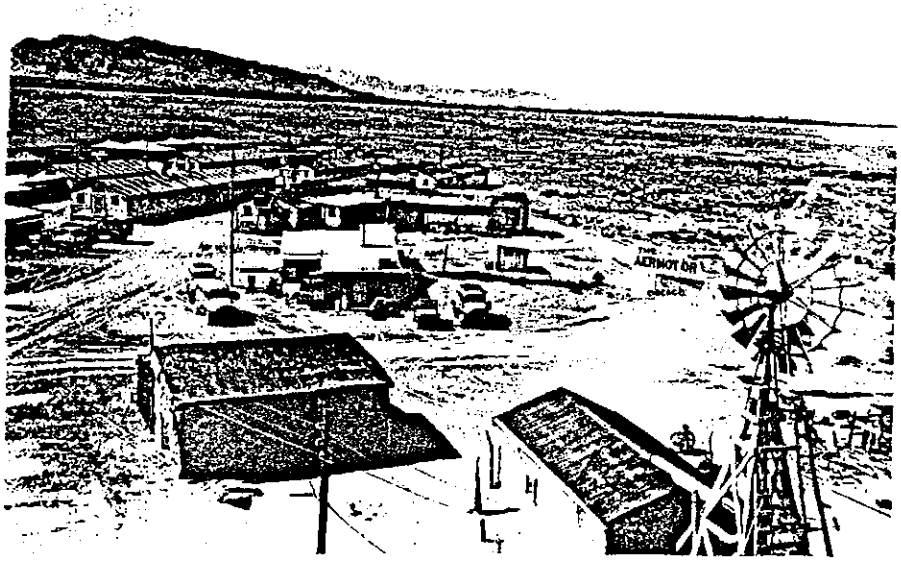
TR-54 Base Camp
"April 1, 1945. General view of MacDonald Ranch headquarters from top of old well derrick."



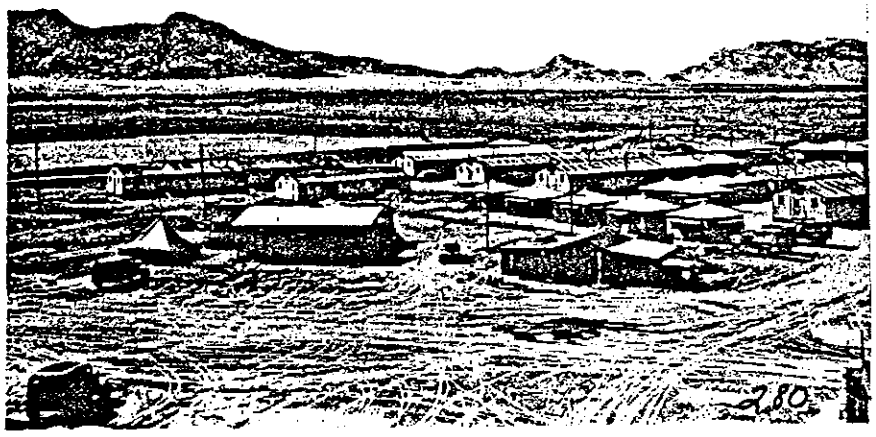
TR-55 Base Camp
"April 5, 1945. Well digging rig at MacDonald Ranch headquarters."



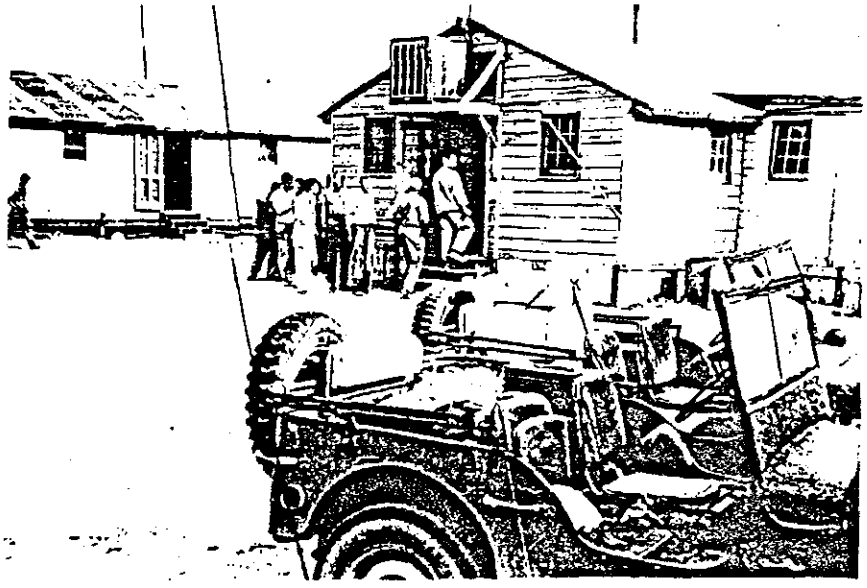
TR-56 Base Camp
"April 10, 1945. Unloading water storage tank at MacDonald Ranch headquarters."



TR-221 Base Camp
"Trinity camp."

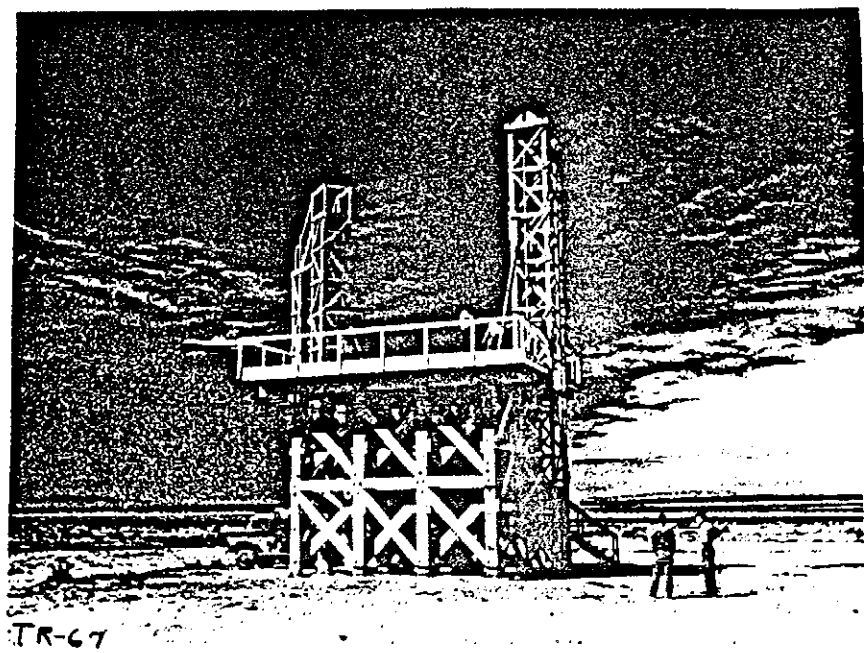


TR-280 Base Camp
"Trinity camp at MacDonald Ranch headquarters."

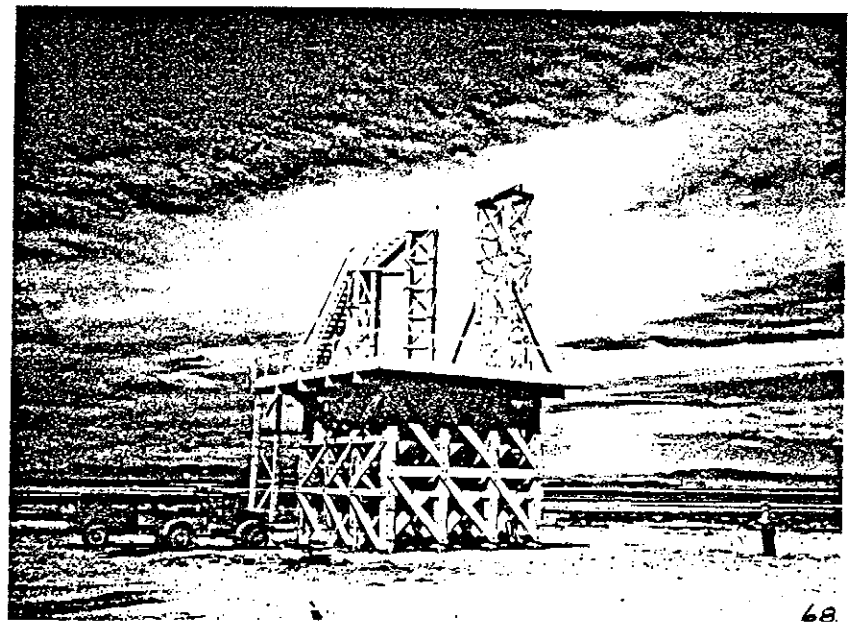


TR-390 Base Camp
"Chow."

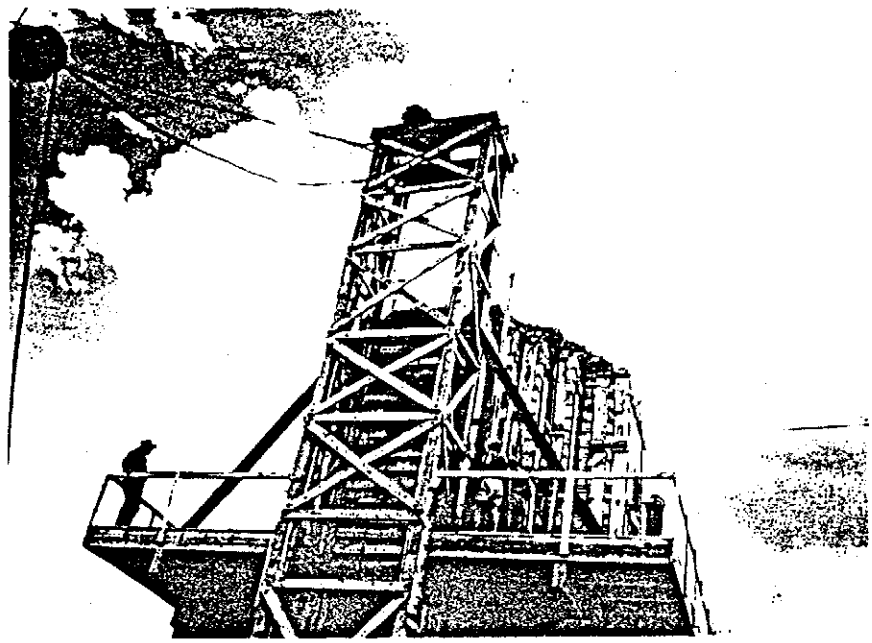
TR-64 100-Ton Test
"April 19, 1945. Construction of 100 T platform at 'Z'. View looking NE."



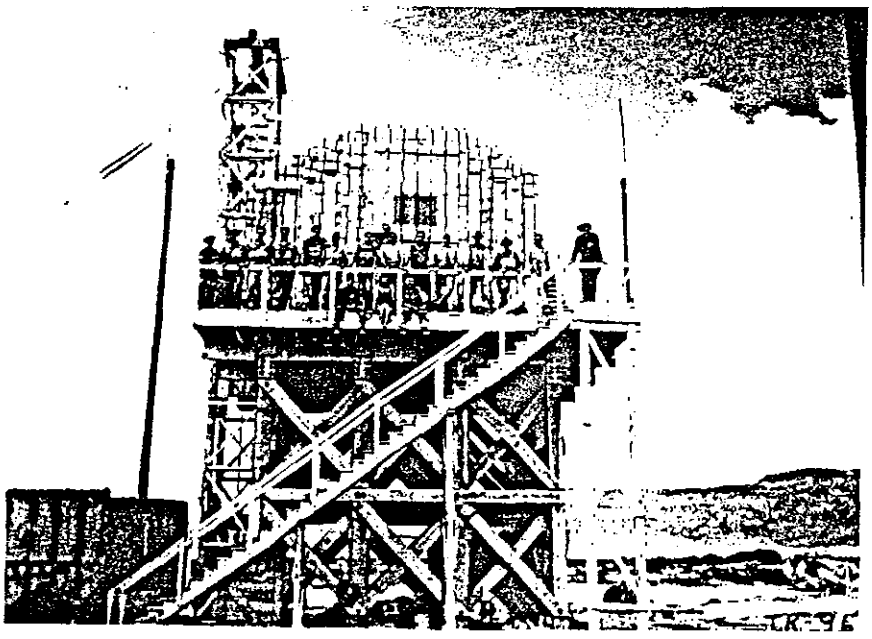
TR-67 100-Ton Test
"April 20, 1945. 100 ton platform complete."



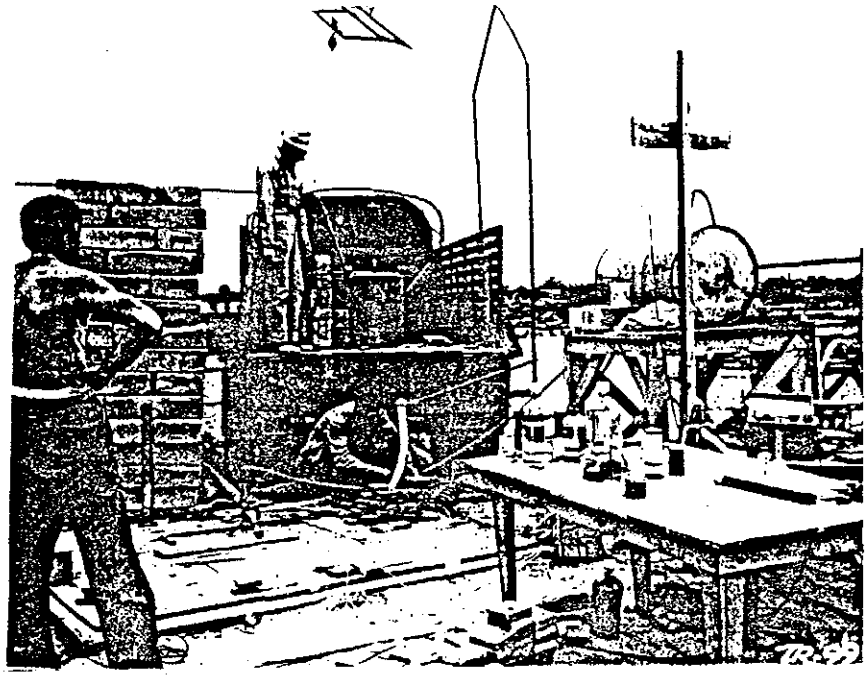
TR-68 100-Ton Test
"April 20, 1945. Completed 100 ton platform at 'Z'."



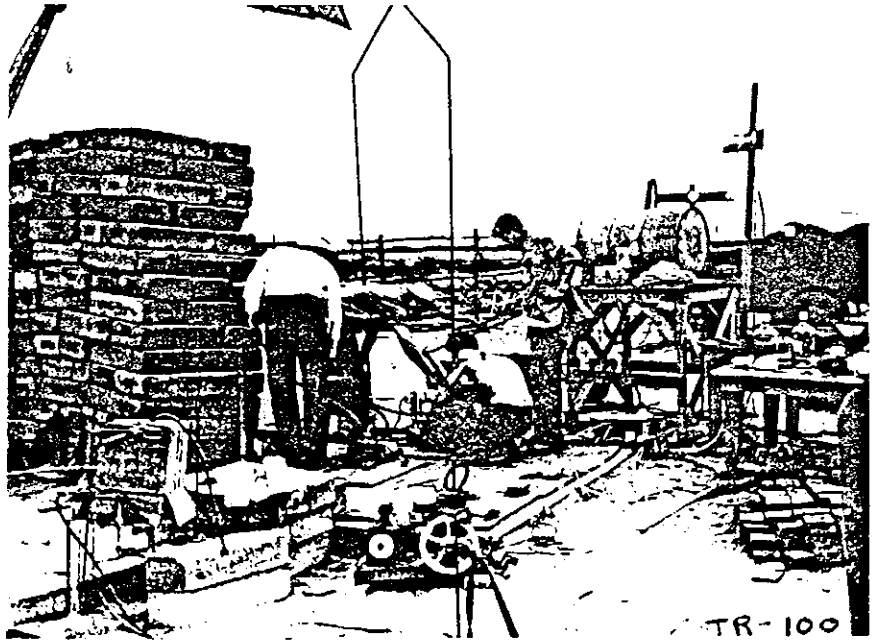
TR-95 100-Ton Test
"100 tons complete."



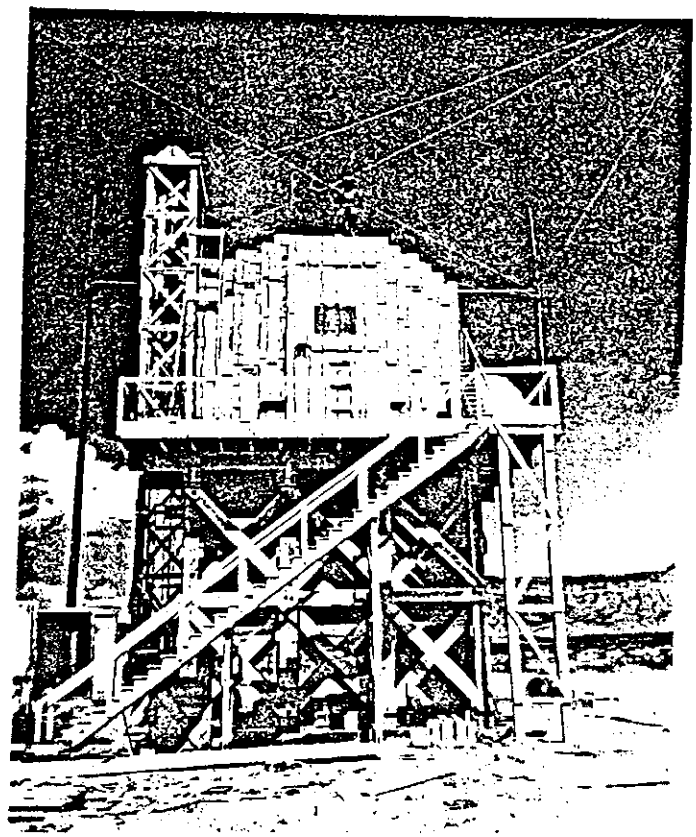
TR-96 100-Ton Test
"May 2, 1945. 100 tons platform and crew that stacked it."



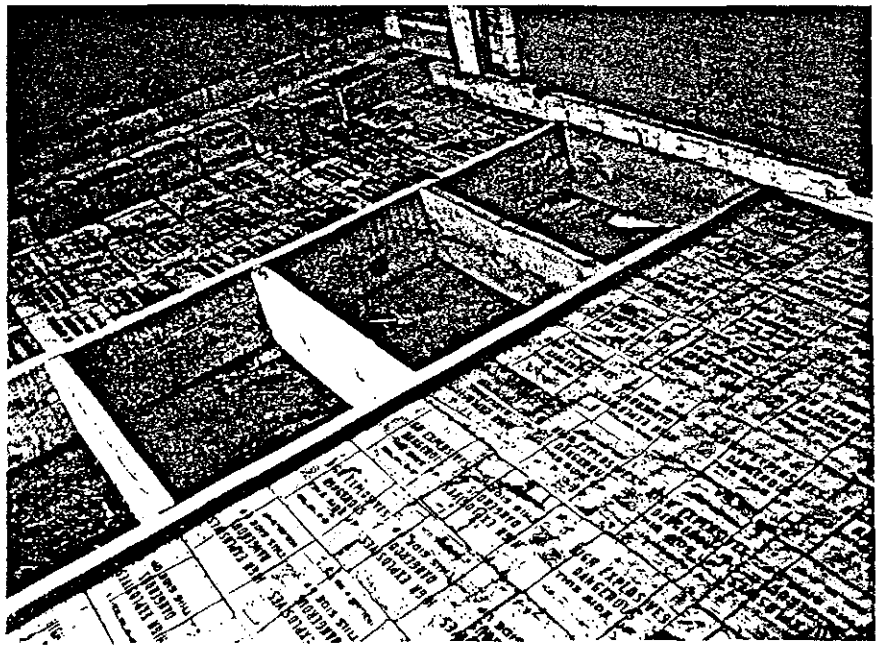
TR-99 100-Ton Test
"May 5, 1945. 'Slug' in place, blocking leaks of radiation."



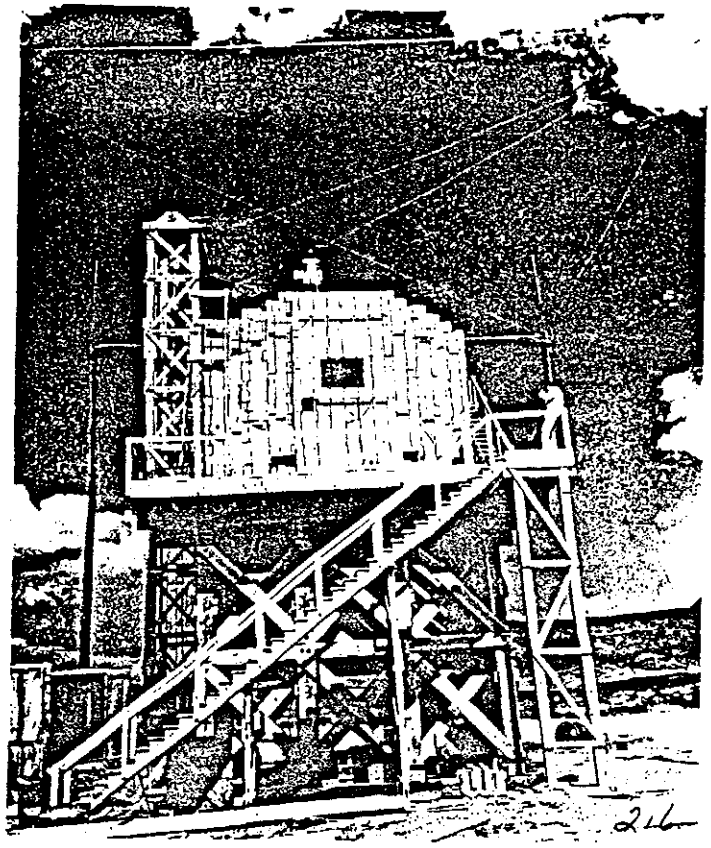
TR-100 100-Ton Test
"May 5, 1945. Testing for leaks around tube through which 'slug' was slid into place."



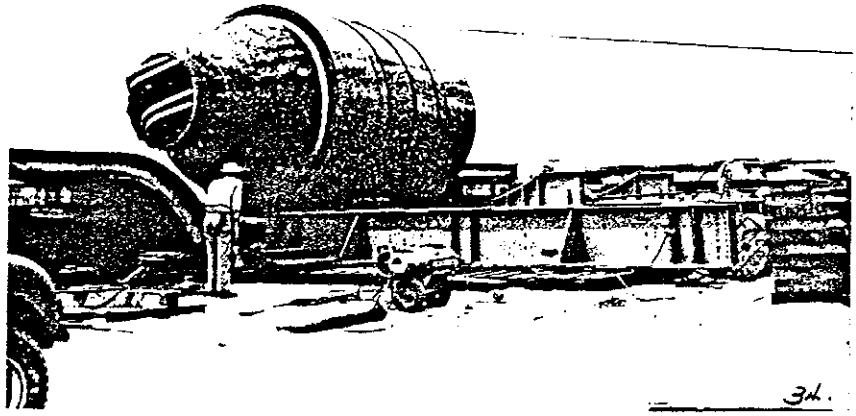
TR-175 100-Ton Test
"100 T complete."



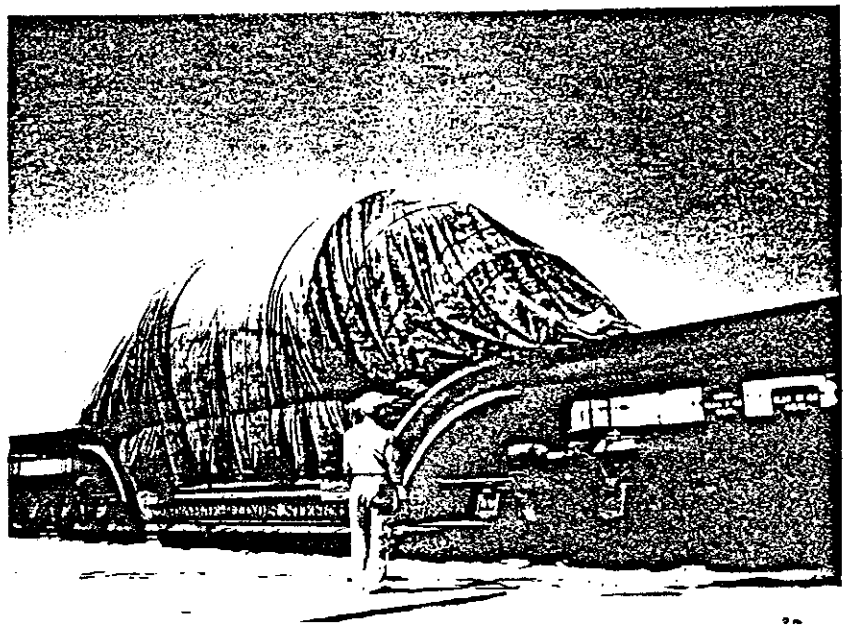
TR-178 100-Ton Test
"April 1945. Packed explosives on tower platform for 100 T test."



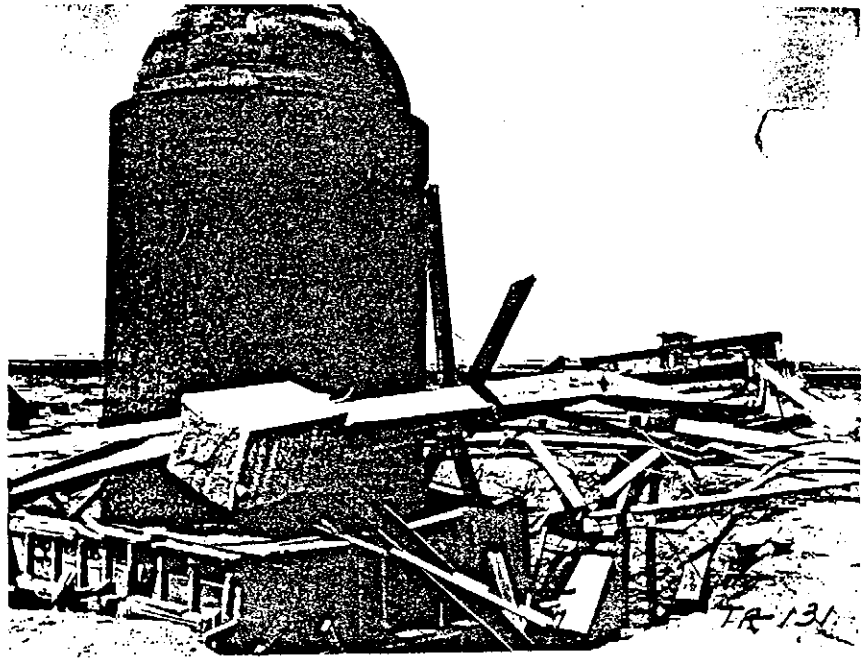
TR-216 100-Ton Test
"100 T complete."



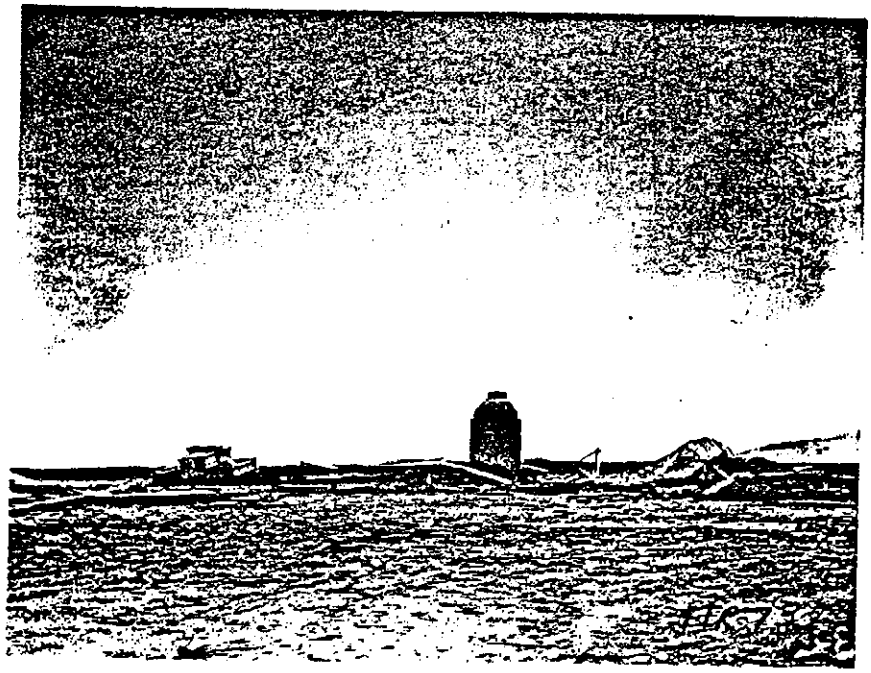
TR-34 Jumbo
"April 16, 1954. Starting to roll Jumbo from freight car onto trailer frame."



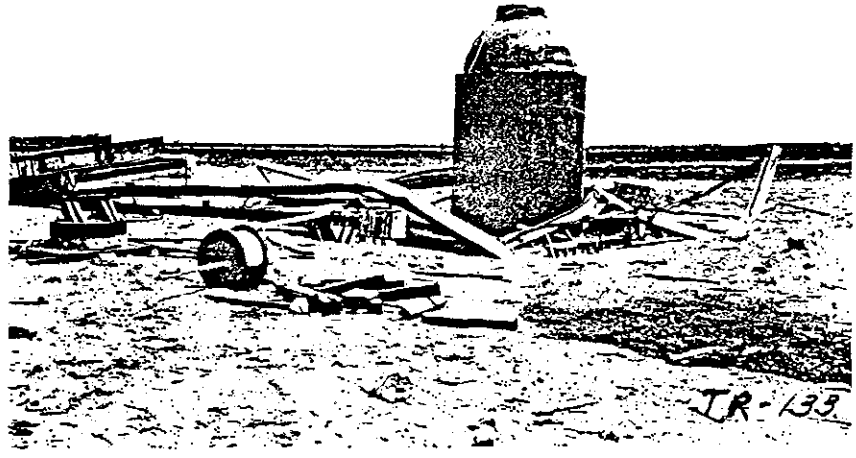
TR-38 Jumbo
"April 13, 1945. Jumbo on special flat car at railroad siding, Pope, N.M."



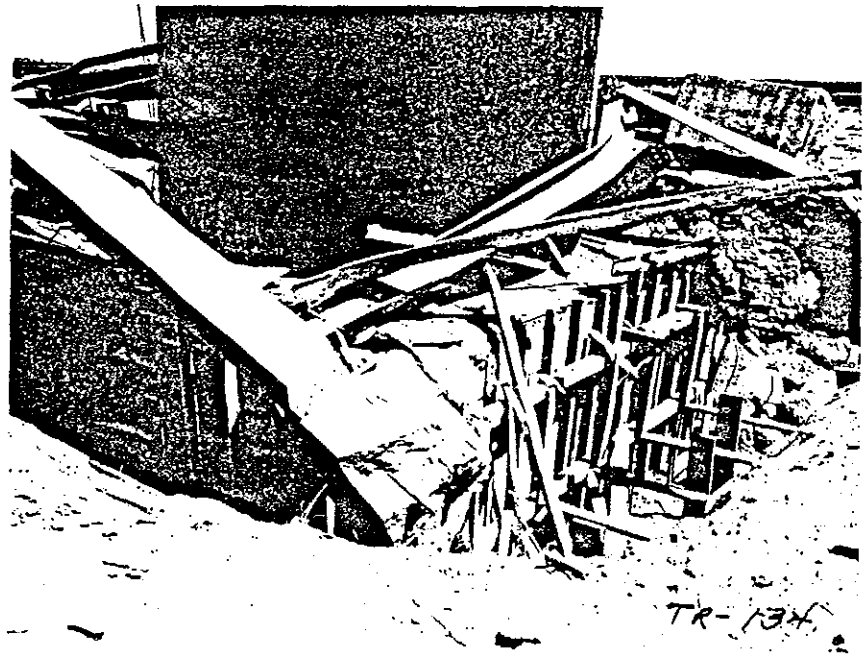
TR-131 Jumbo
"July 16, 1945. Jumbo tower after gadget."



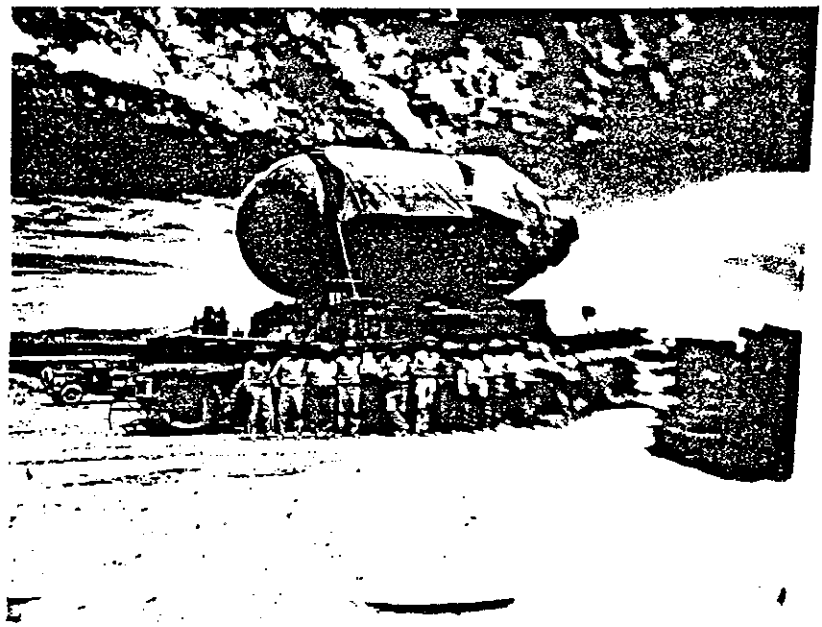
TR-132 Jumbo
"July 16, 1945. Jumbo tower after gadget."



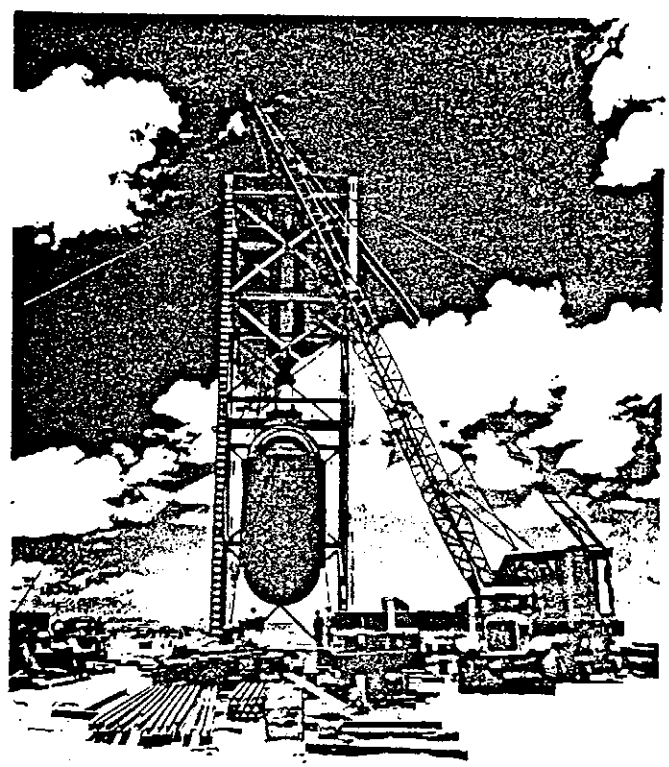
TR-133 Jumbo
"July 16, 1945. Jumbo tower after gadget."



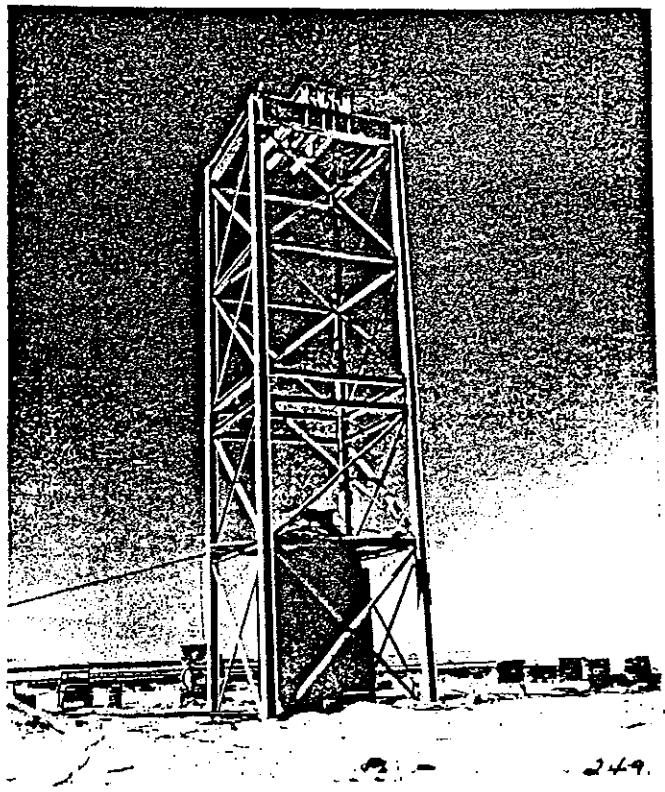
TR-134 Jumbo
"July 16, 1945. Jumbo tower after gadget."



TR-157 Jumbo
"May 1945. Jumbo on trailer at Pipe. Loading crew standing."

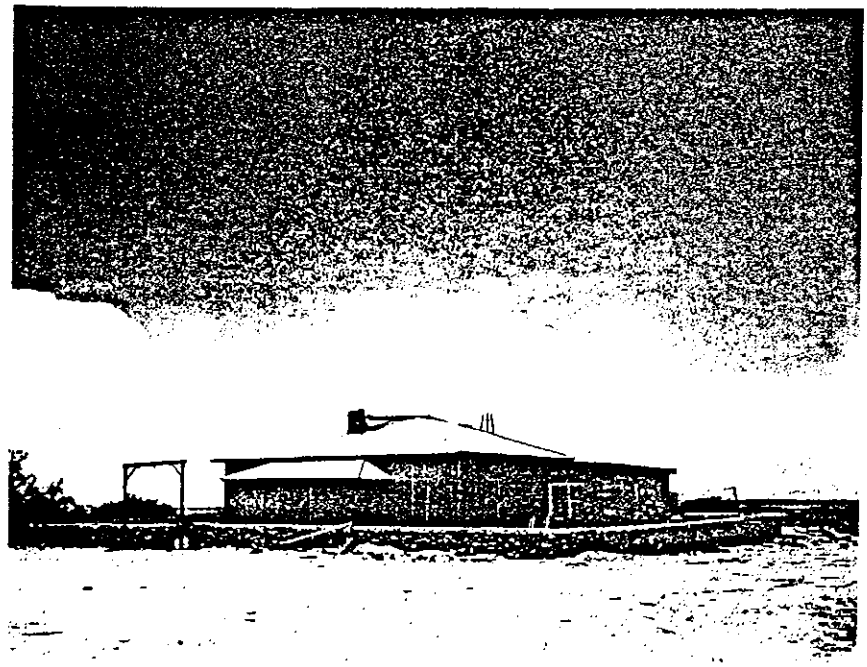


TR-179 Jumbo
"May 1945. Jumbo suspended in tower and ready for lowering to its foundation."

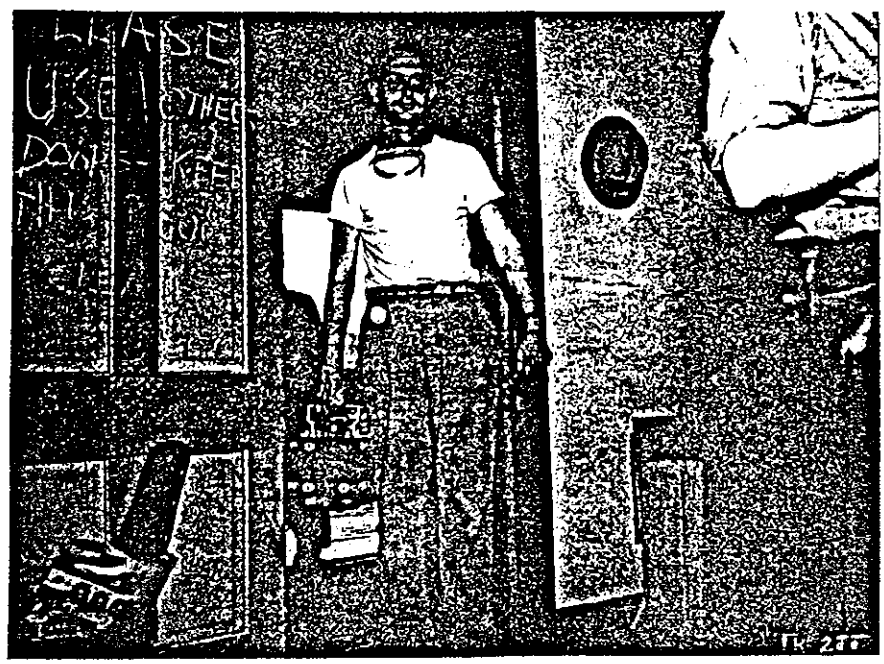


TR-249 Jumbo
"Jumbo and tower complete."

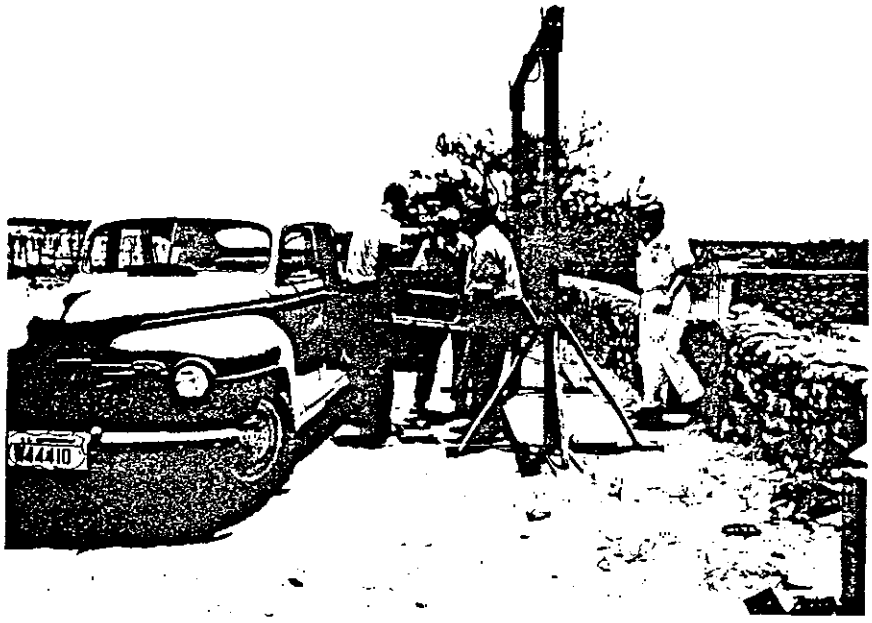
TR-53 MacDonald Ranch
"April 1, 1945. Corrals and stable at MacDonald Ranch.



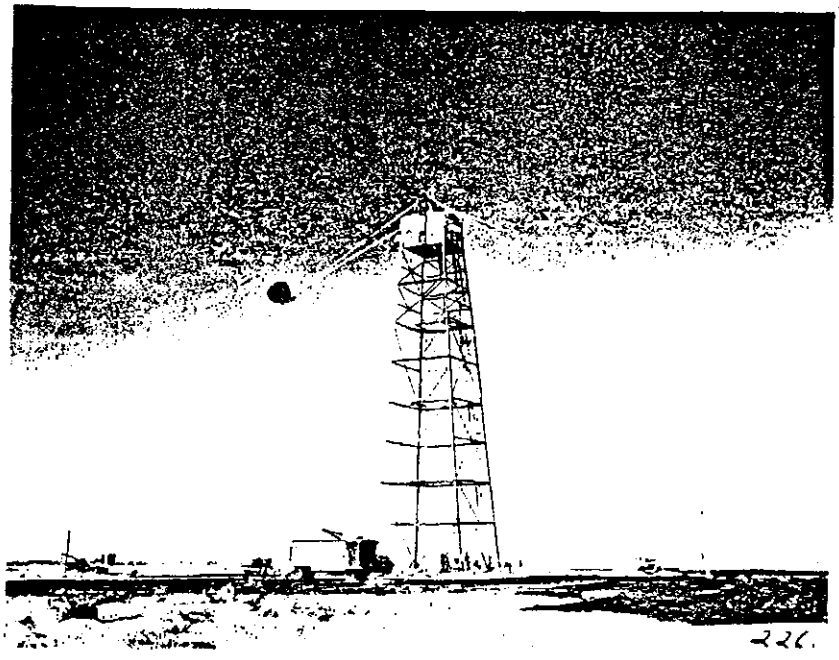
TR-244 MacDonald Ranch
"MacDonald Ranch."



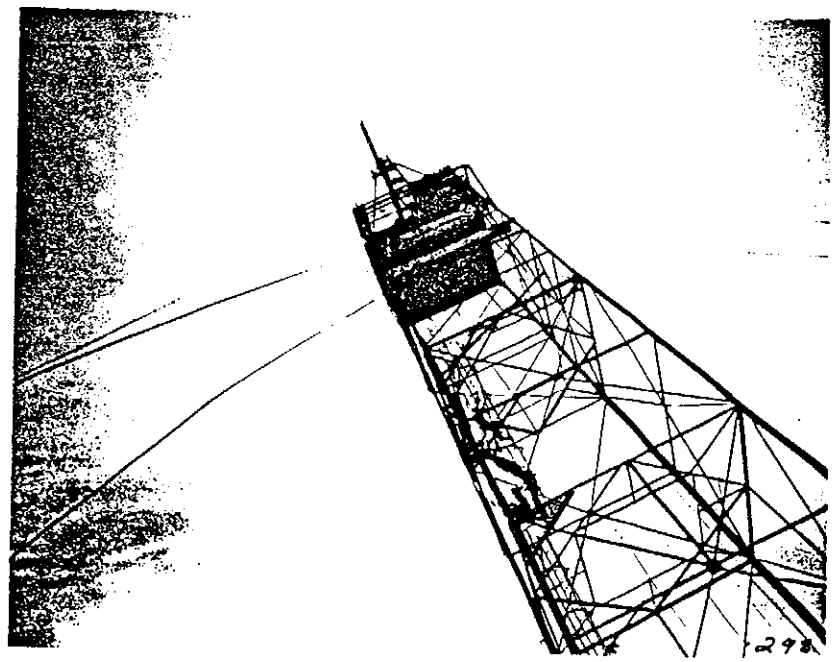
TR-277 MacDonald Ranch
"Active material. H. M. Lehr."



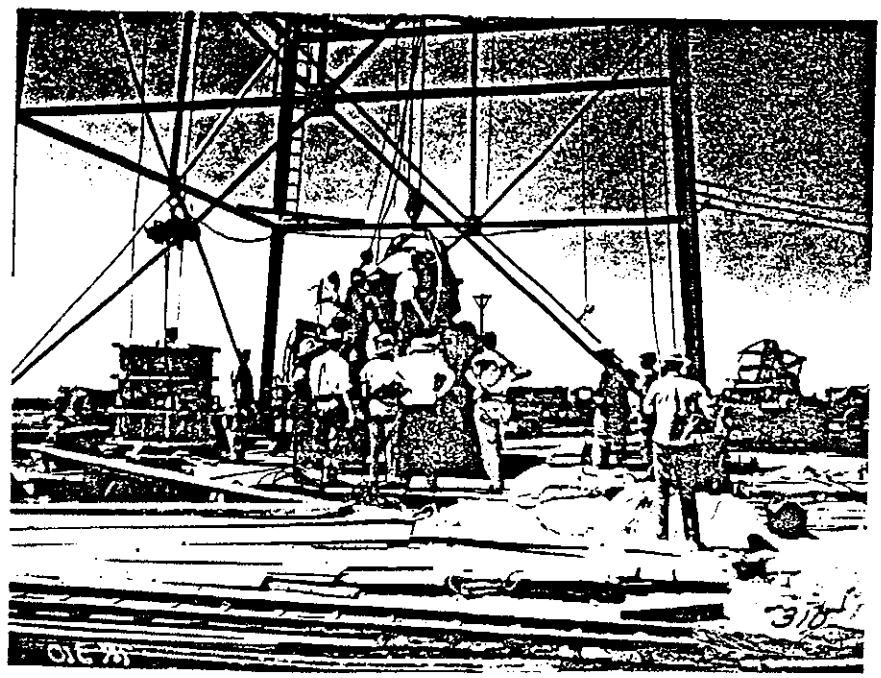
TR-312 MacDonald Ranch
"Slug leaves for tower."



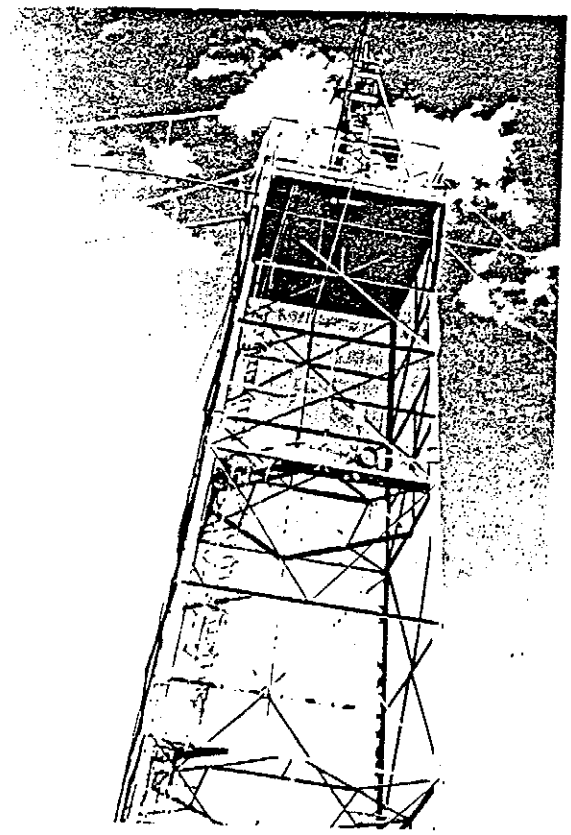
TR-226 Ground Zero
"Gadget tower."



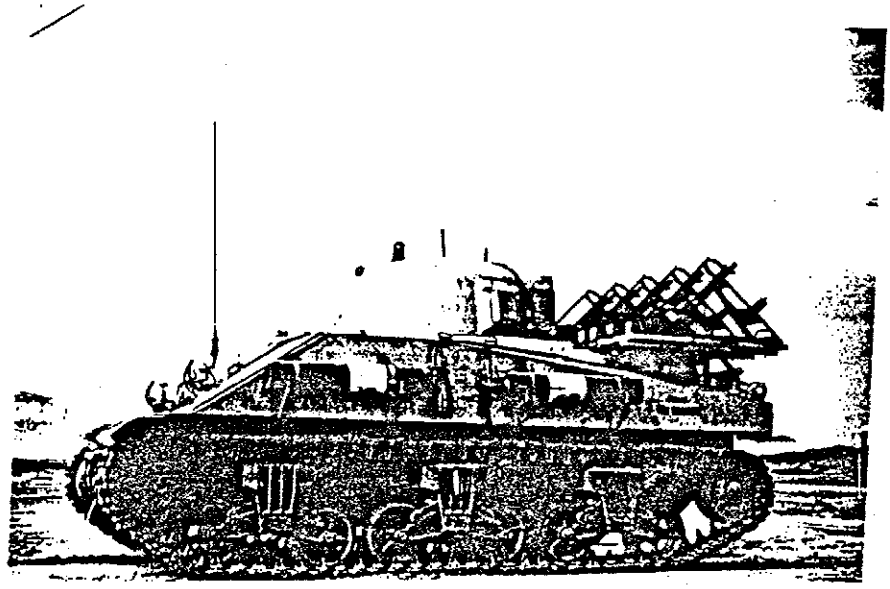
TR-298 Ground Zero
"Bomb tower."



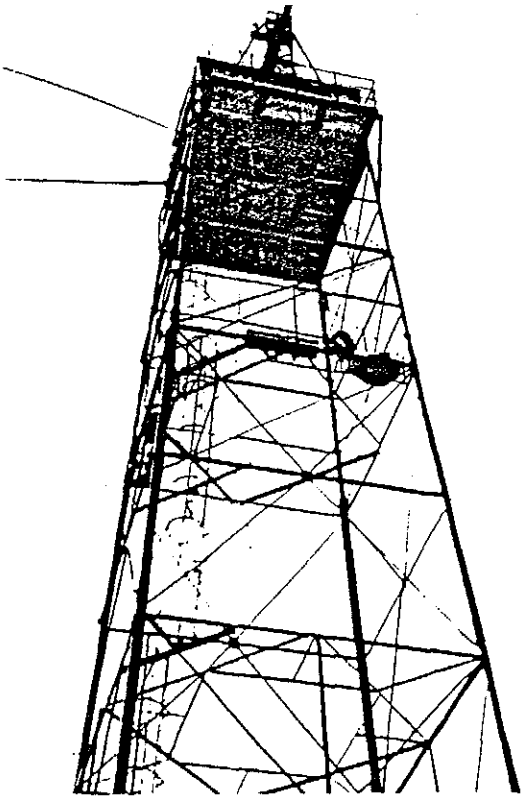
TR-310 Ground Zero
"Activity at base of tower."



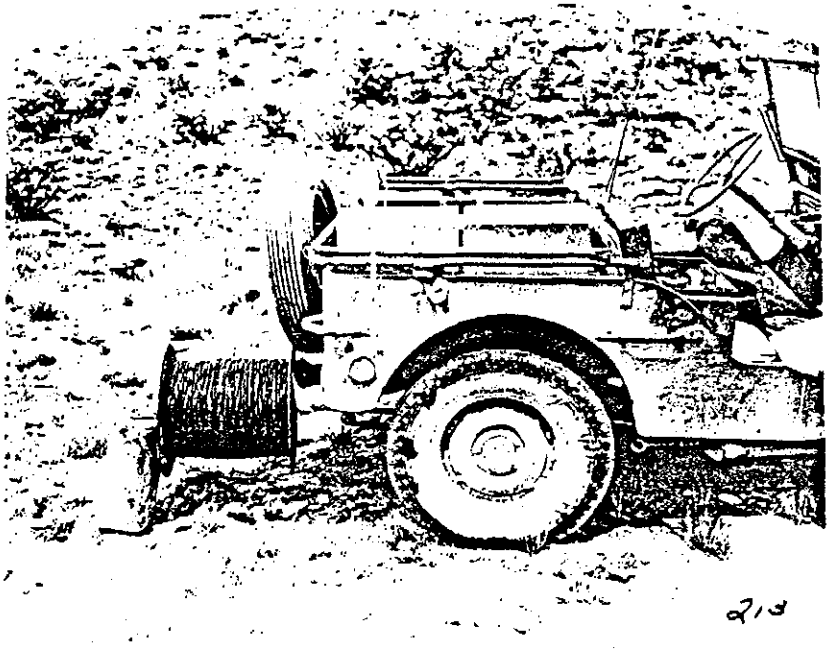
TR-386B Ground Zero
"Tower at 'O'."



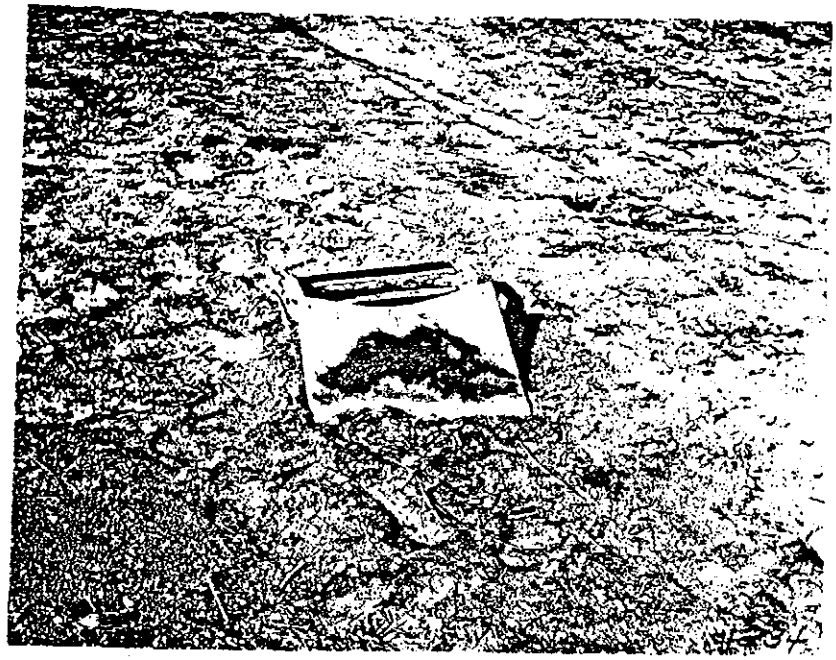
TR-392A Ground Zero
"Special tank for soil sample collection."



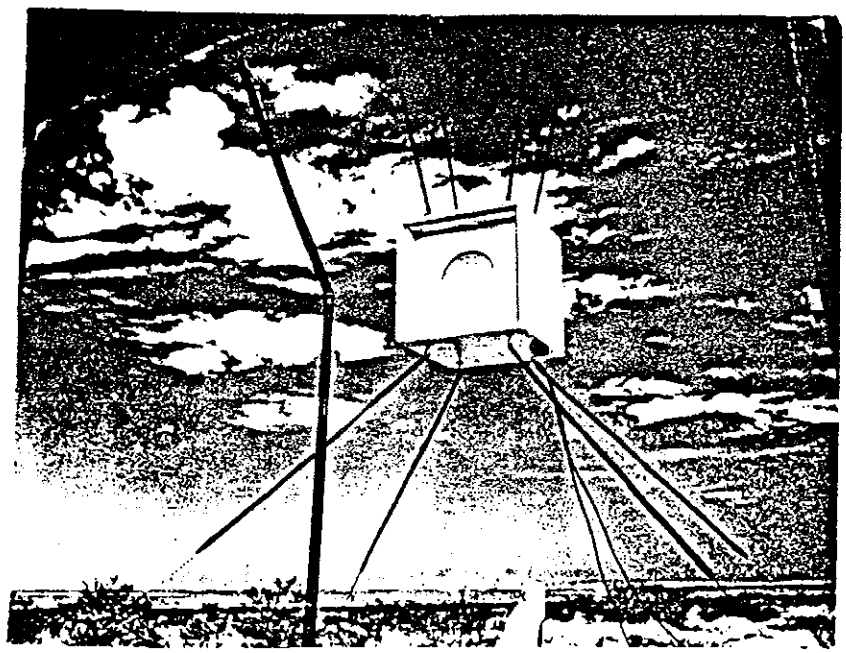
TR-783 Ground Zero
"Trinity atom tower."



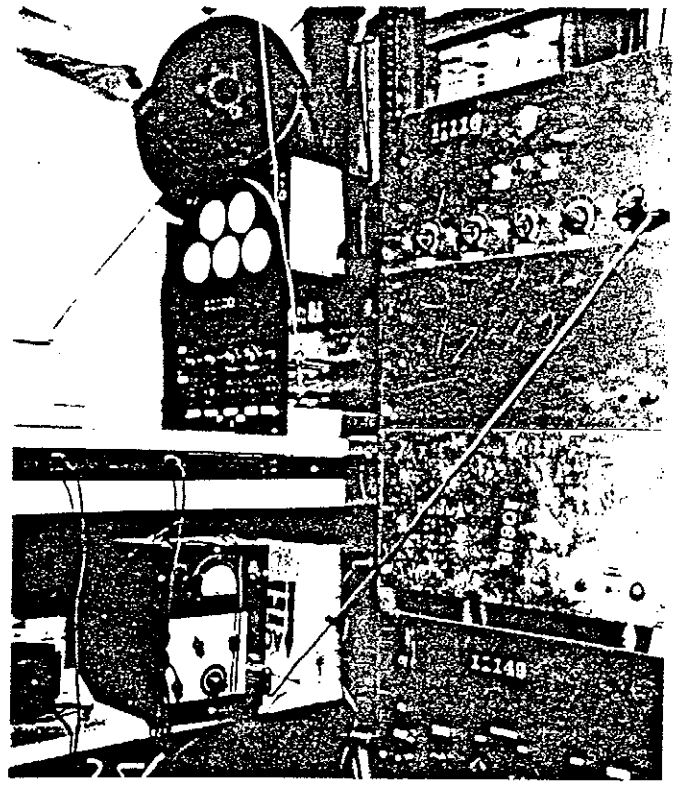
TR-213 Site Instrumentation
"Wire laying set-up."



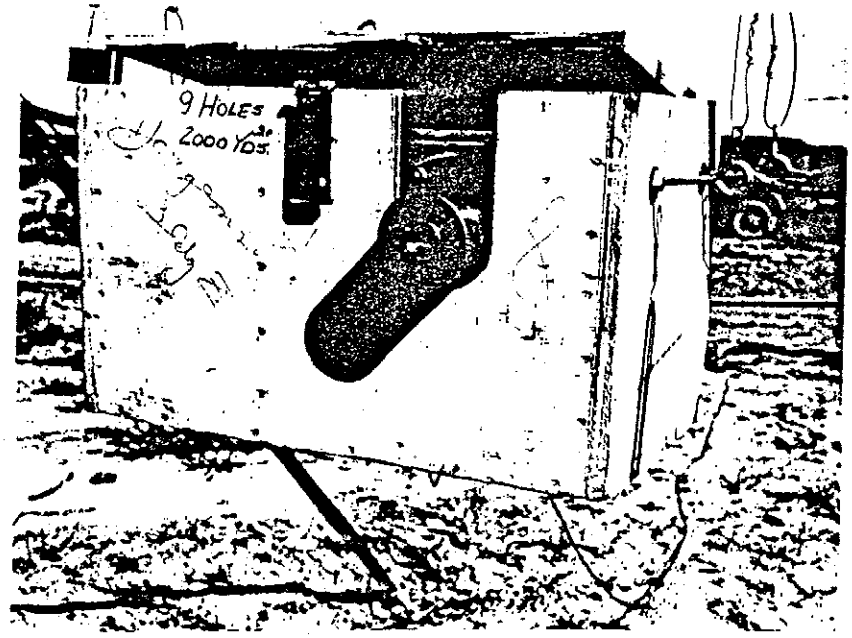
TR-234 Site Instrumentation
"Station about 300 yards South after blast."



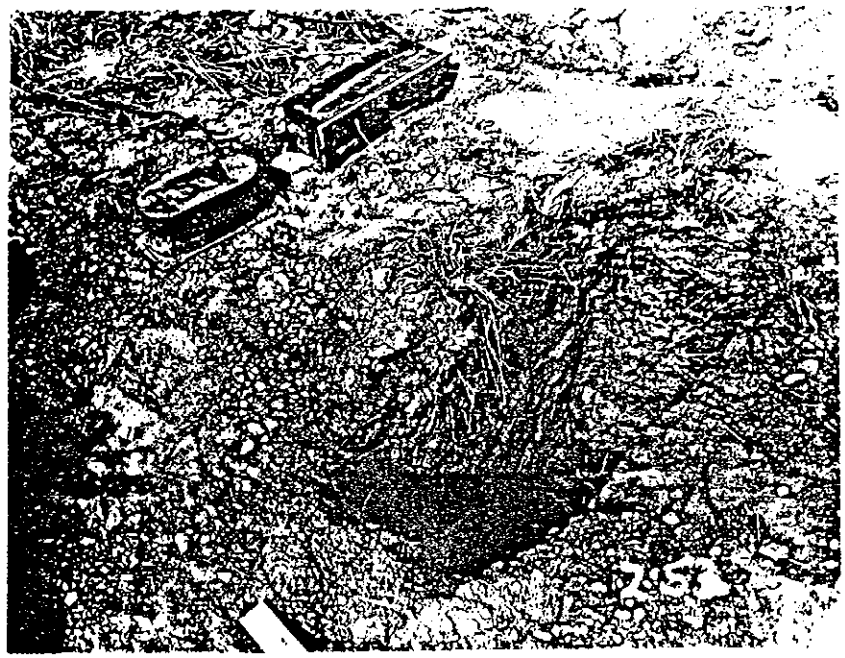
TR-250 Site Instrumentation
"Micophone pickup for excess velocity measurements.
Barschall and Davis."



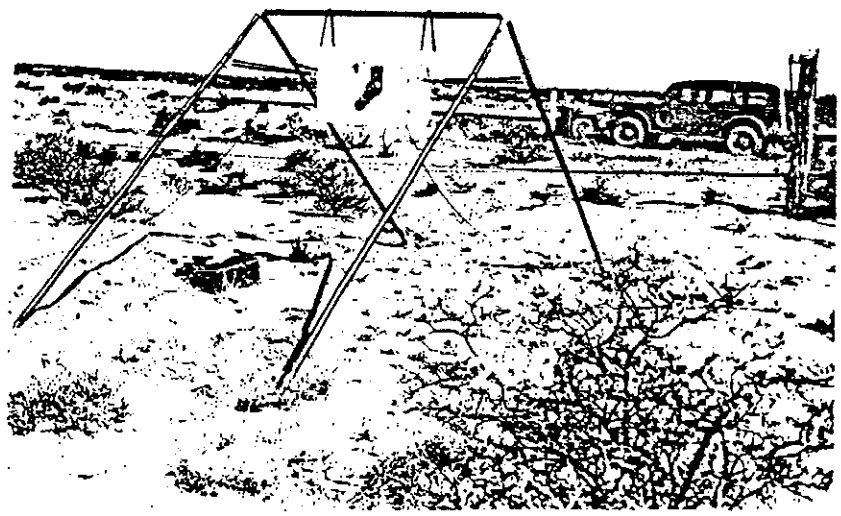
TR-251 Site Instrumentation
"Apparatus for some velocity measurements."



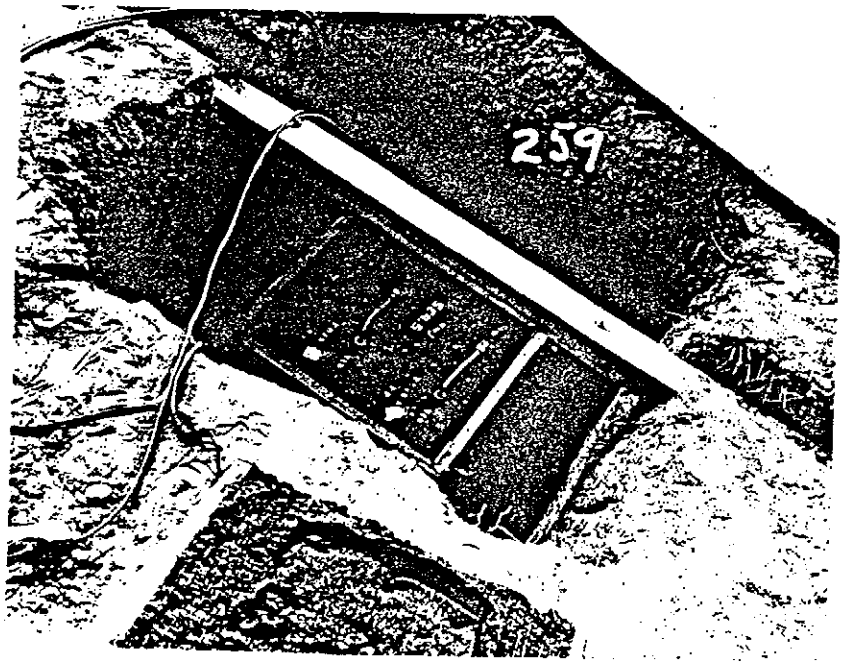
TR-252 Site Instrumentation
"Mechanical impulse gauges."



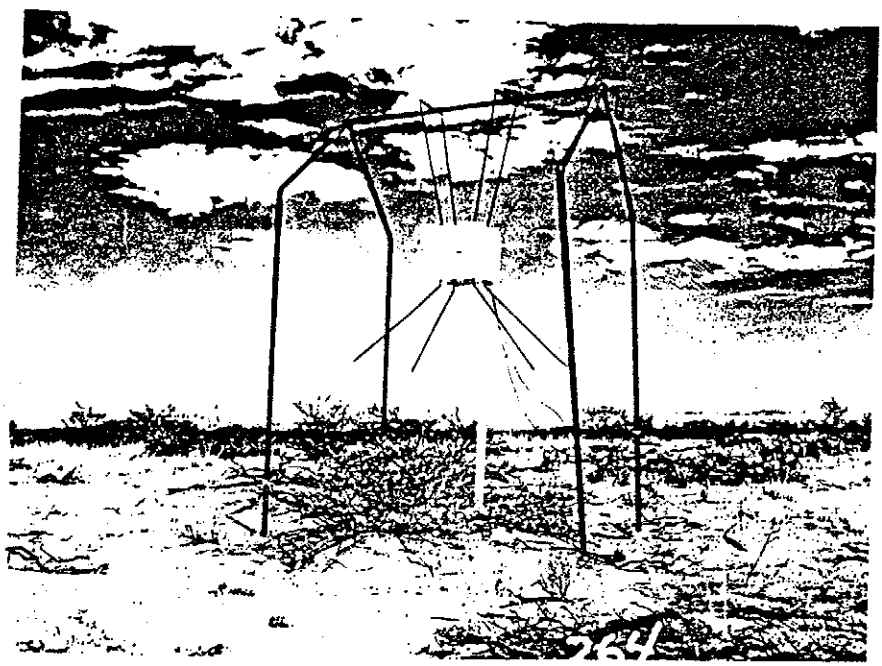
TR-253 Site Instrumentation
"Geophones. J. H. Coon."



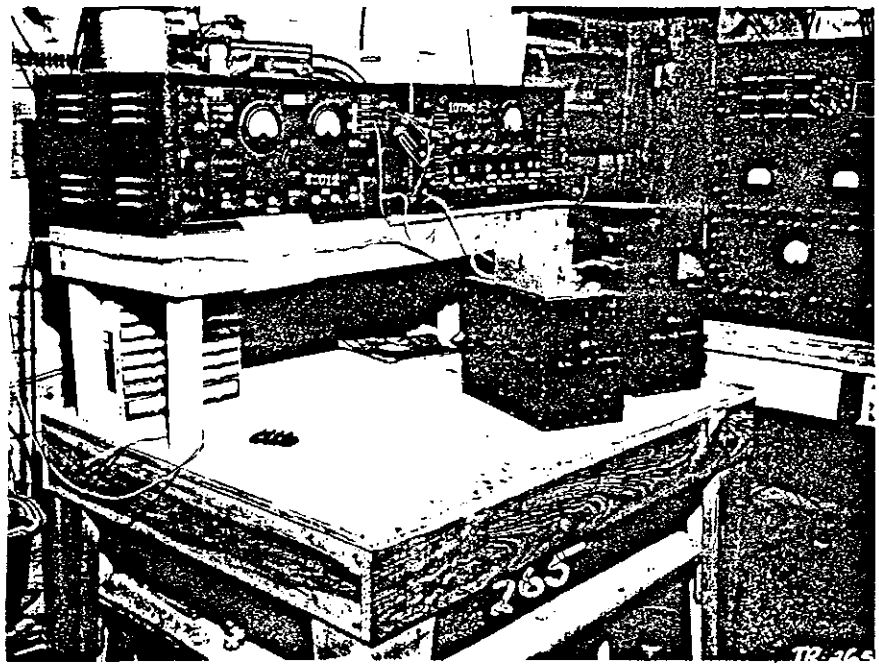
TR-258 Site Instrumentation
"Mechanical impulse gauge. Jorgenson."



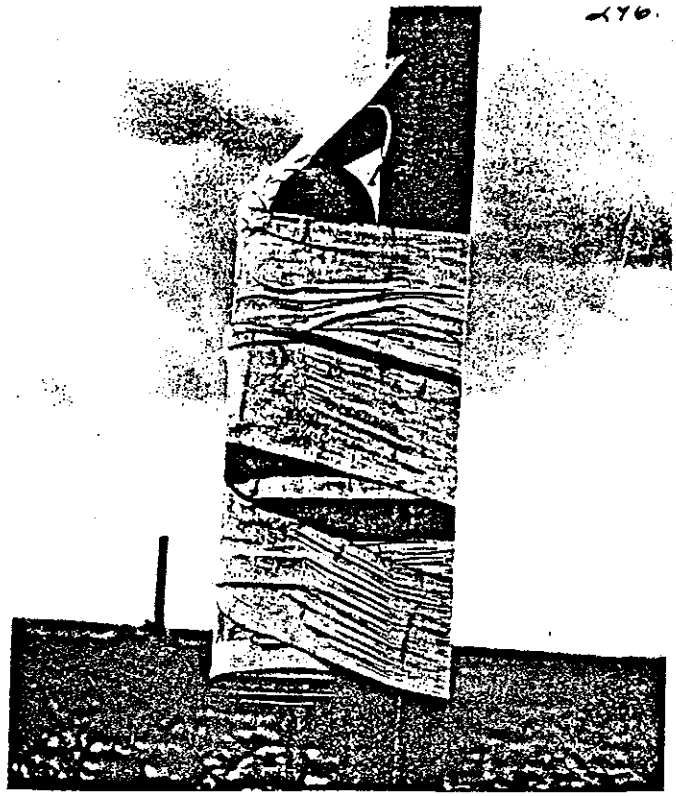
TR-259 Site Instrumentation
"Geophone amplifiers. Coon, Houghton."



TR-264 Site Instrumentation
"Microphone pickup for excess velocity measurements. Barschall."

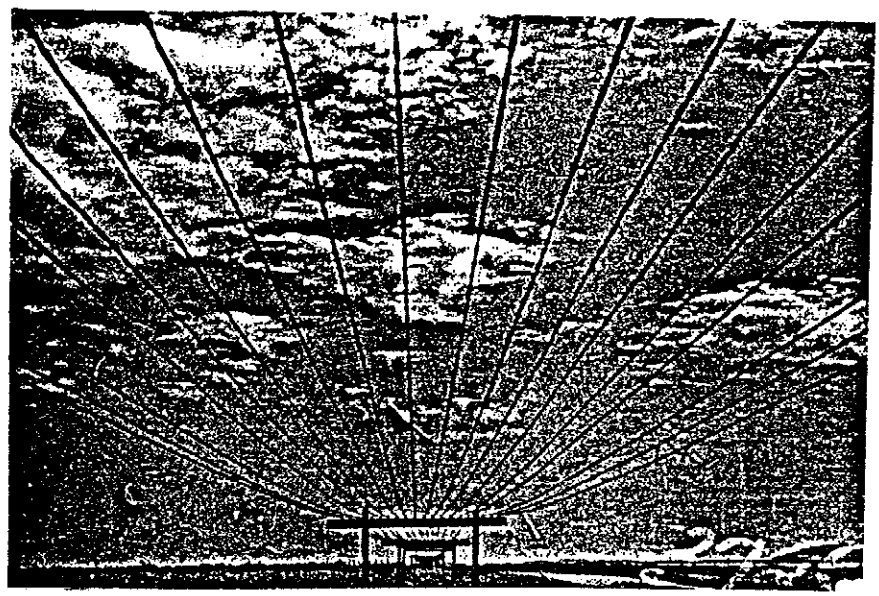


TR-265 Site Instrumentation
"Geophone recording equipment. Coon."



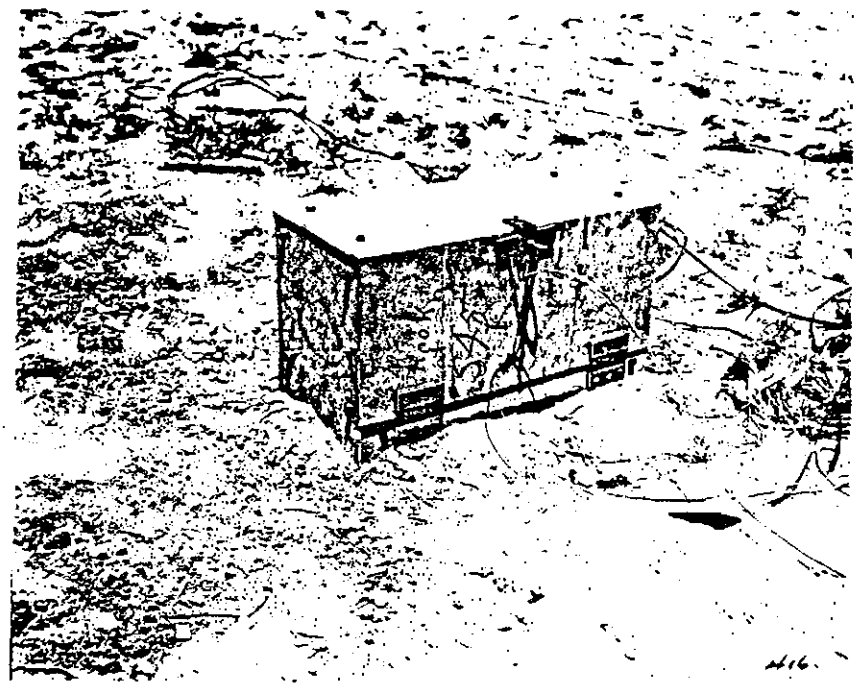
TR-296 Site Instrumentation
"Flash bomb to illuminate cloud."

TR-329 Site Instrumentation
"Bomb set-up to illuminate cloud. Neil York."

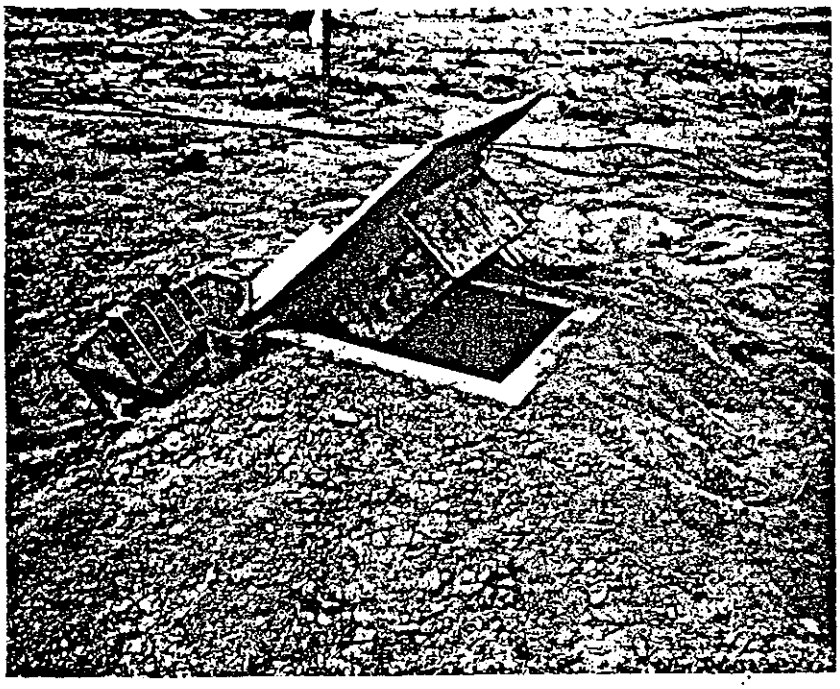


TR-372C Site Instrumentation
"Signal wires near point B."

TR-406 Site Instrumentation
"Shelter for equipment used to measure delayed ionization at Trinity. See LA-433 by Moon."

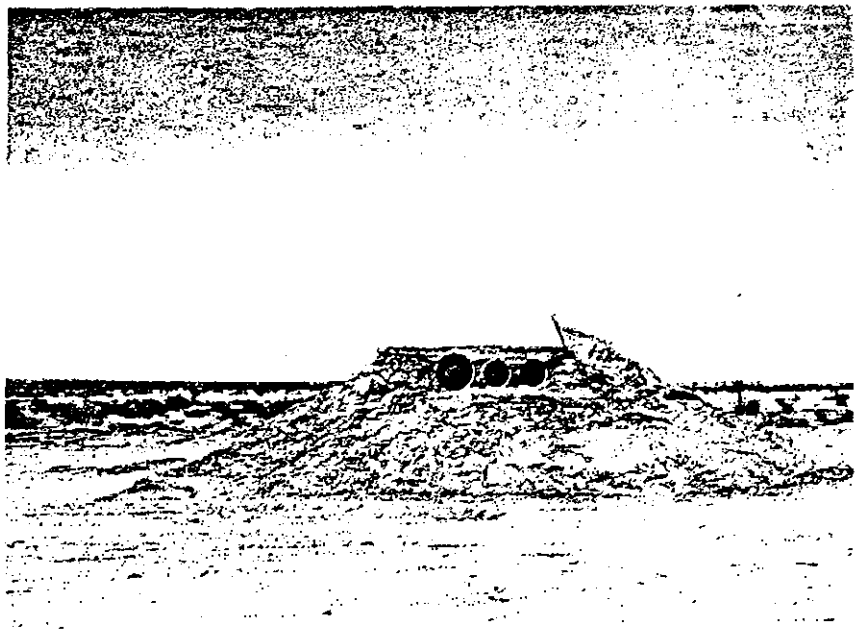


TR-416 Site Instrumentation
"Box containing neutron time camera. Richards, Frisch, Krohn."

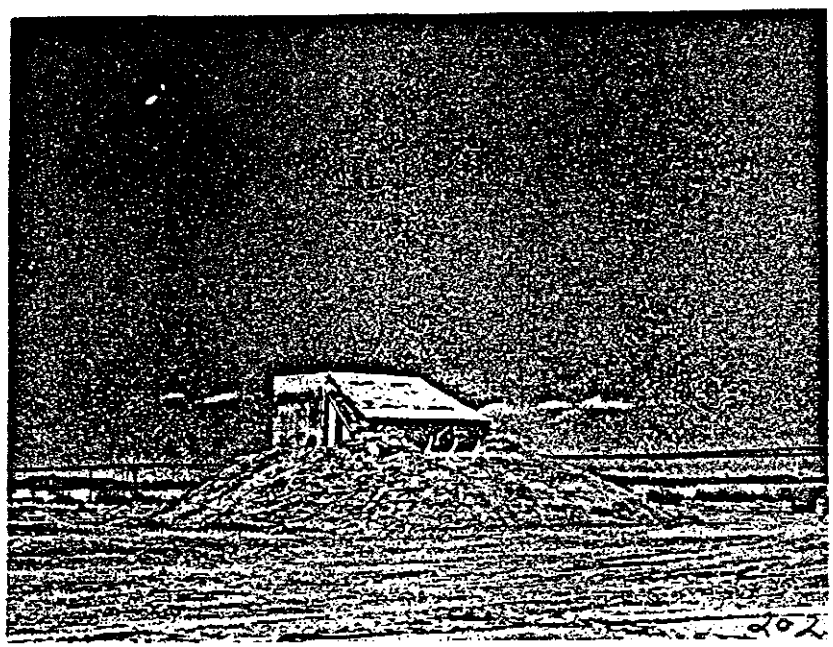


TR-418 Site Instrumentation
"Shelter for equipment used to measure delayed ionization at Trinity. Shelter is open to expose instruments."

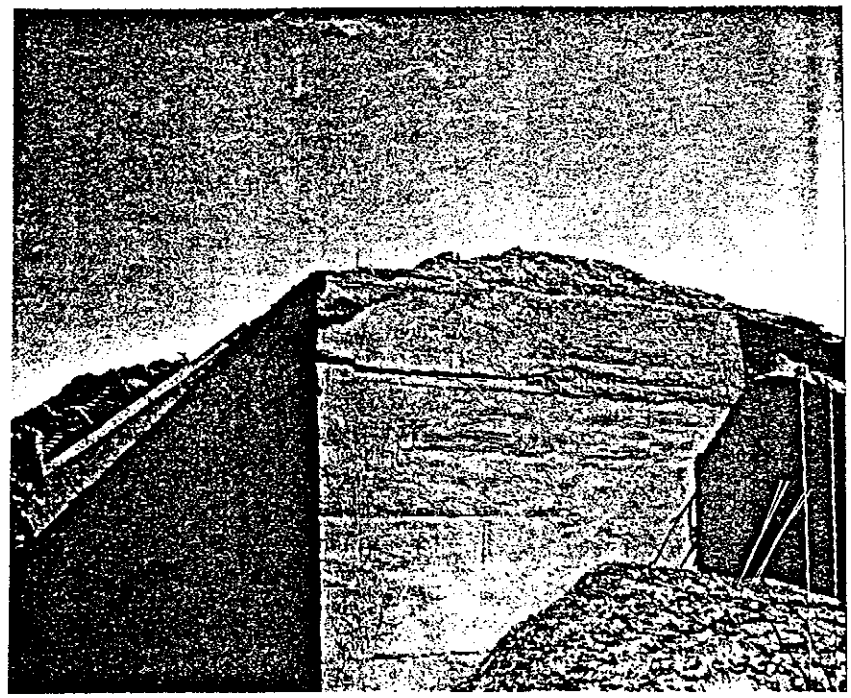
TR-43 800 North
"800 yard N site."



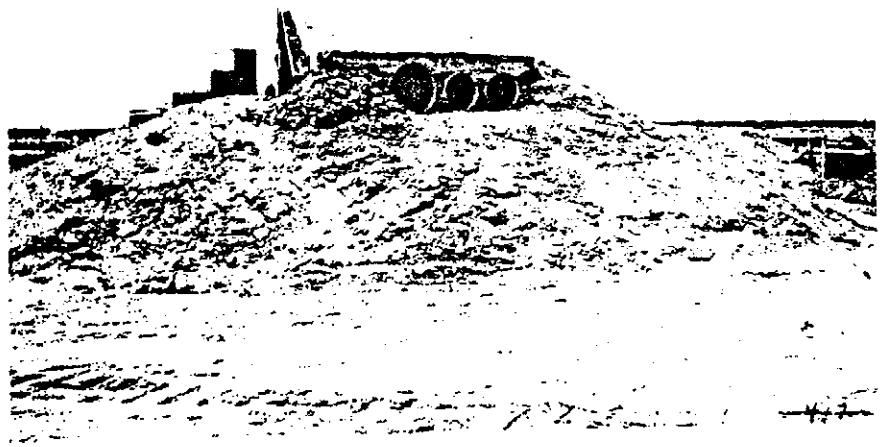
TR-44 800 North
"800 yard N site view from 'O' showing three camera port holes."



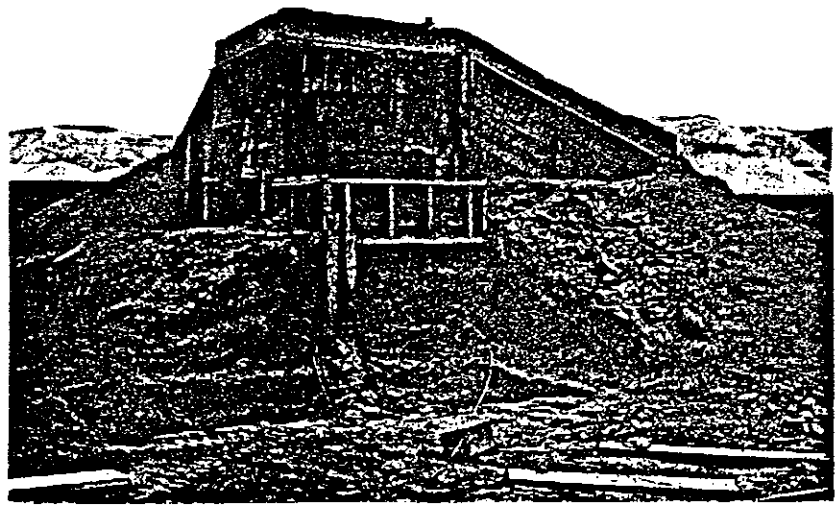
TR-202 800 North
"800 N station."



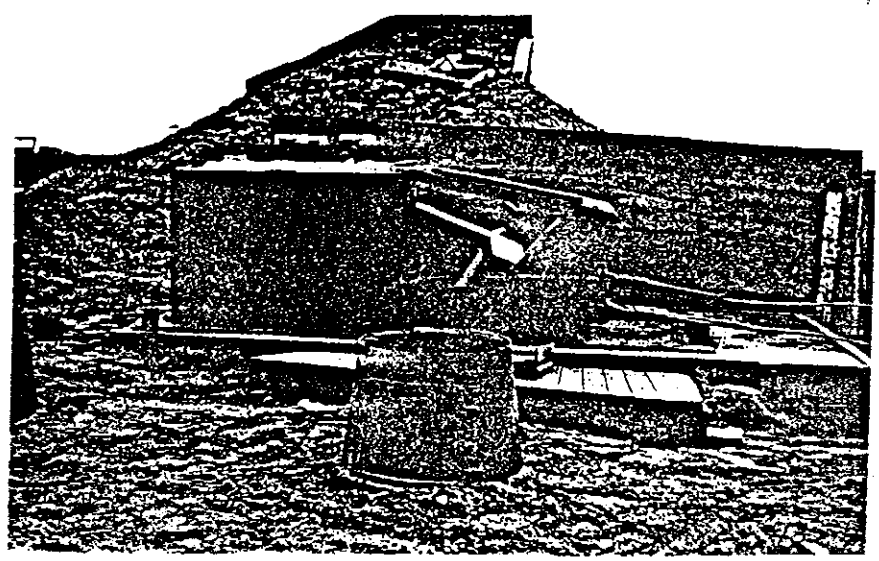
TR-331 800 North
"800 N station after shot (detail)."



TR-417 800 North
"800 yards North. Photo station."

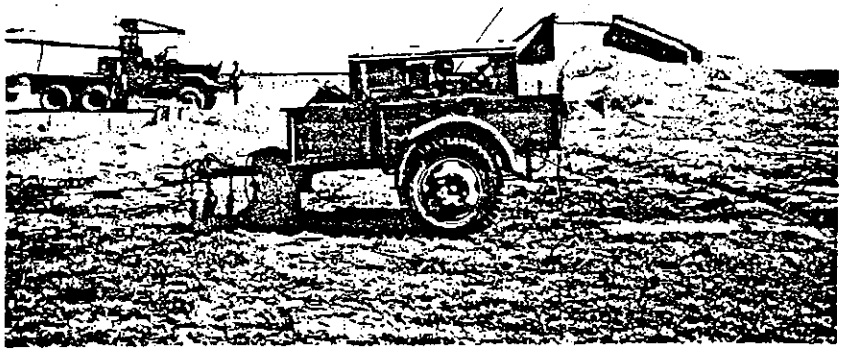


TR-424 800 North
"800 yards North."

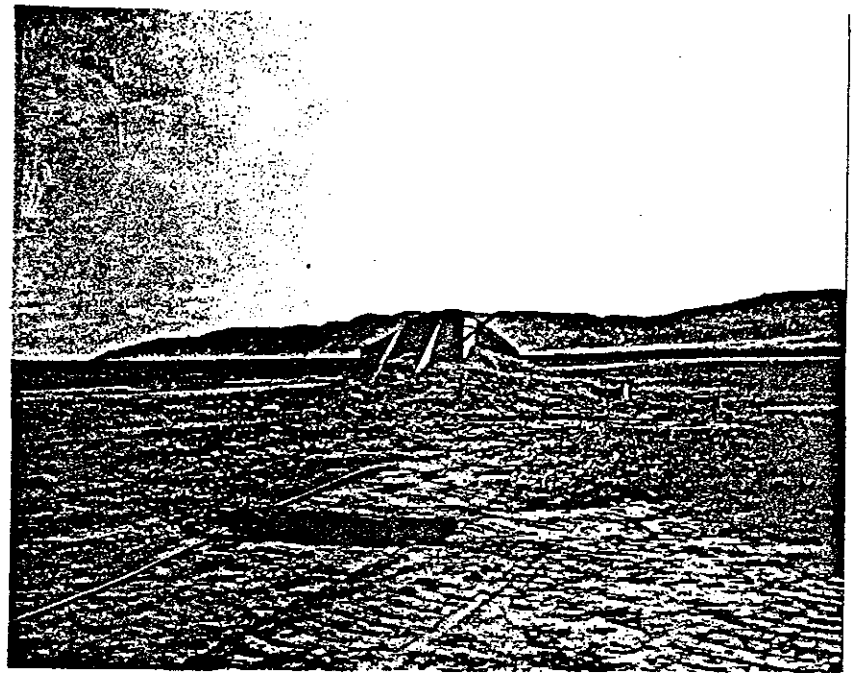


TR-432 800 North
"800 yards North, Fastax sled."

TR-235 800 West
"Going 800 W after shot."

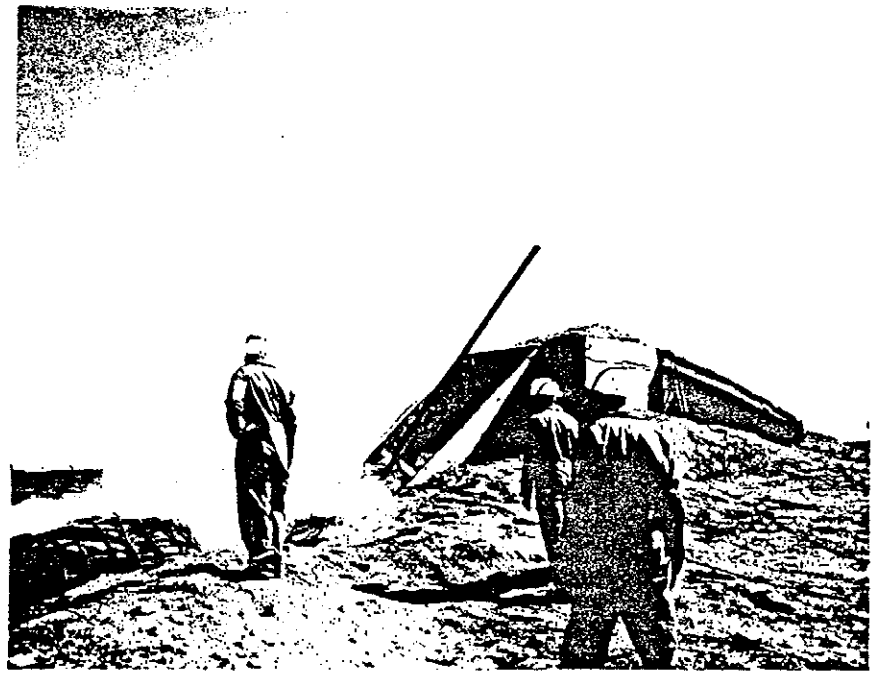


TR-287 800 West
"800 W after shot."

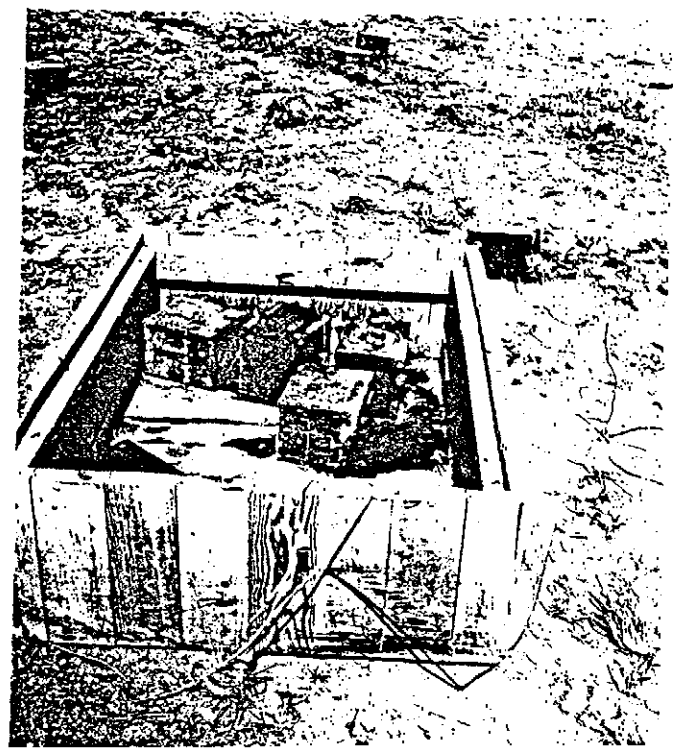


TR-302 800 West
"800 W after shot."

TR-342 800 West
"Near 800 W station, shows sandbags in net at left of picture, small instrumentation shelter at right."



TR-343 800 West
"Removing sandbags at 800 W shelter."

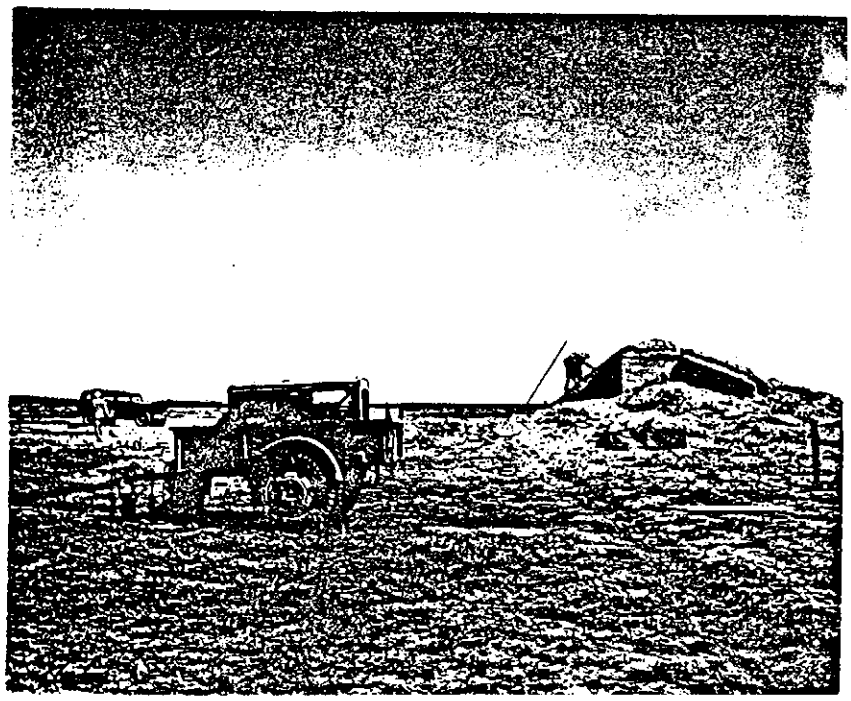


TR-346 800 West
"800 W (?) shows storage batteries in wooden box.
Photo probably taken after explosion July 16."

TR-347 800 West
"Shows 800 W shelter as seen after July 16 explosion."

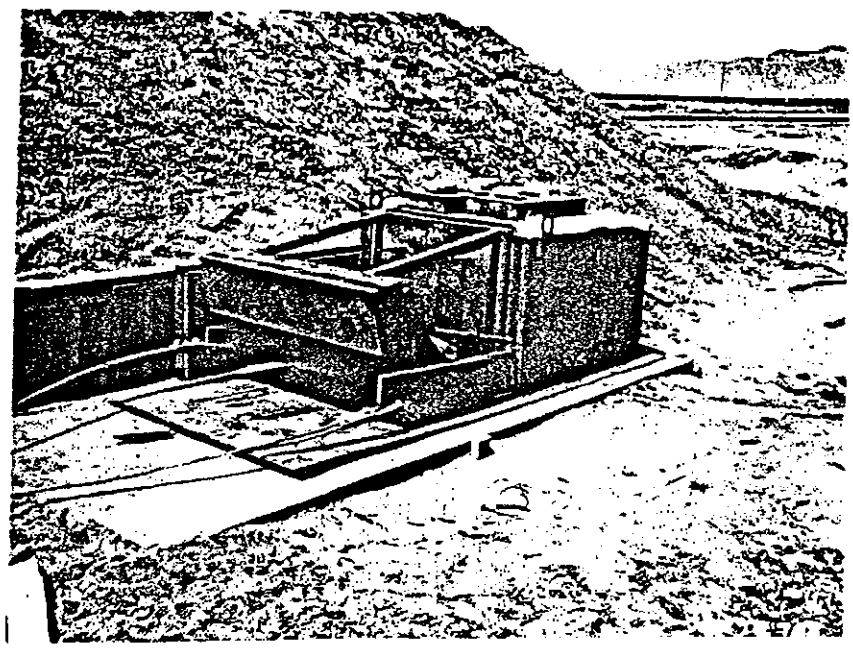
TR-364 800 West
"W 800 after shot."

TR-365 800 West
"800 W shelter, shows sandbag closure to shelter."

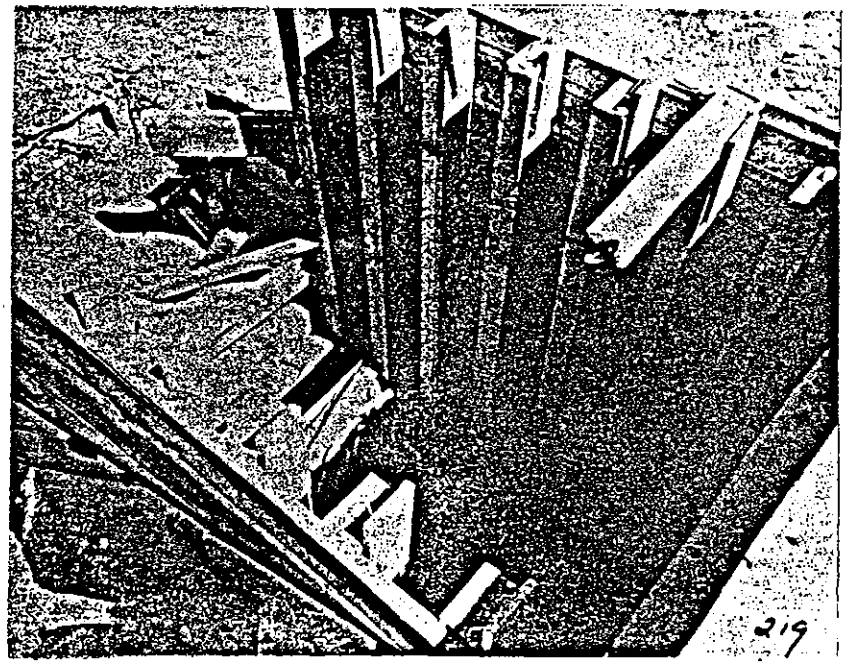


TR-366 800 West
"Uncovering W 800 after shot."

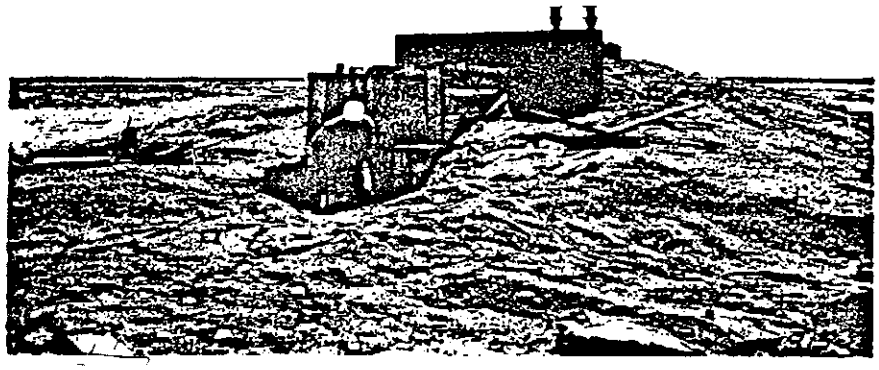
TR-388 800 West
"Shelter at 800 yards west."



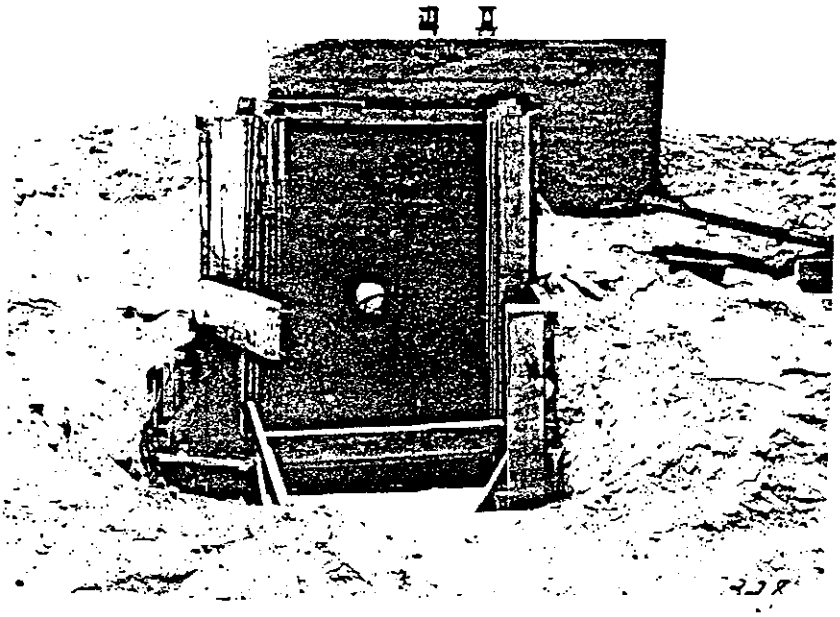
TR-782 800 West
"Station Q. 800 W. Fastax shelter and sled."



TR-219 600 Northwest
"Northwest station after gadget."

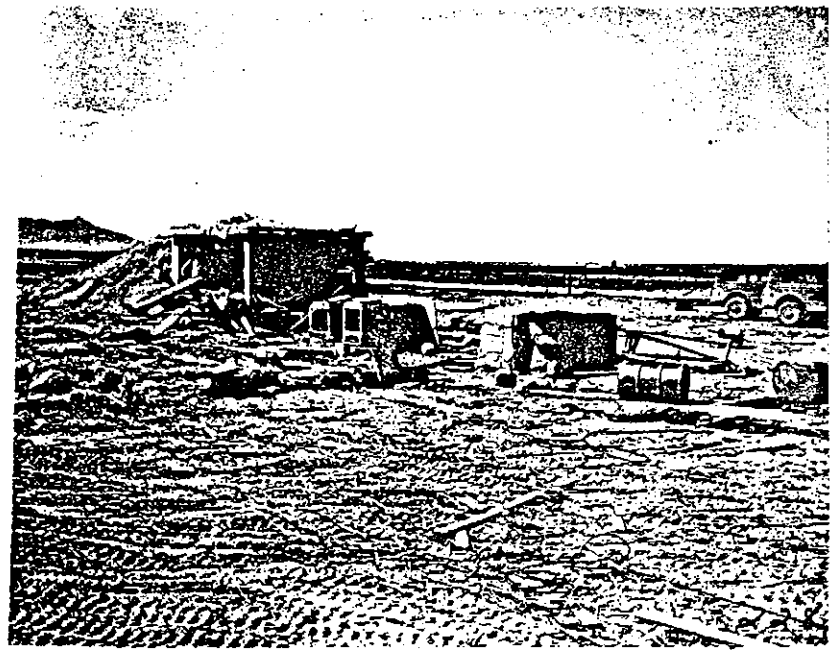


TR-315 600 Northwest
"Northwest station after shot."

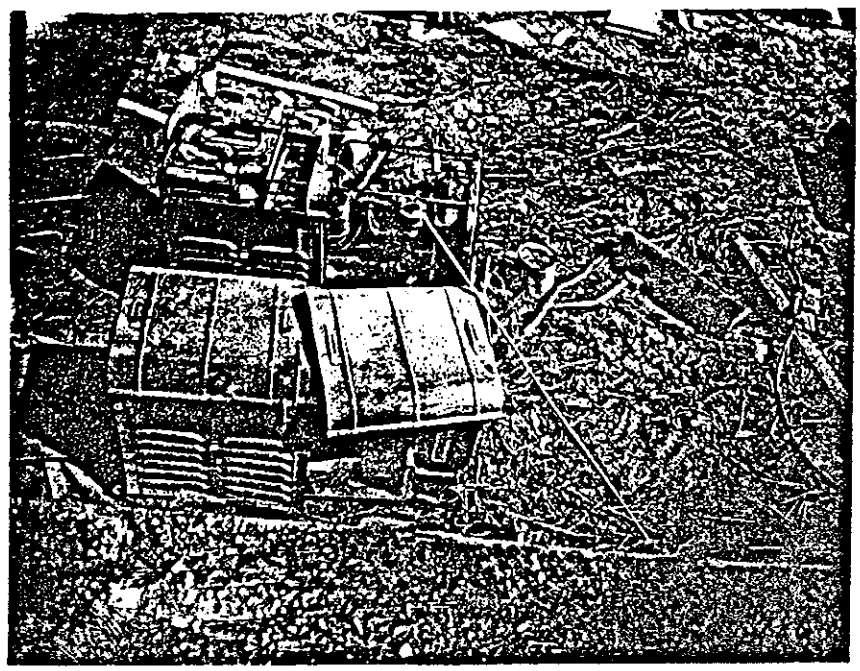


TR-328 600 Northwest
"Northwest station after shot."

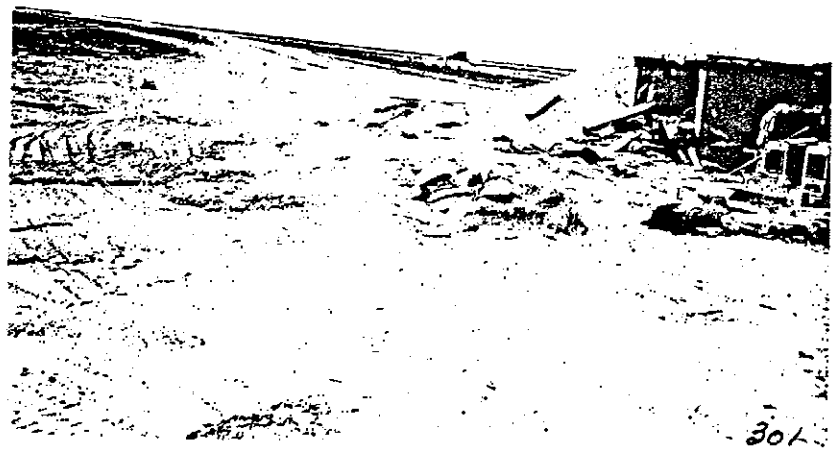
TR-217 1000 North
"1000 N after gadget."



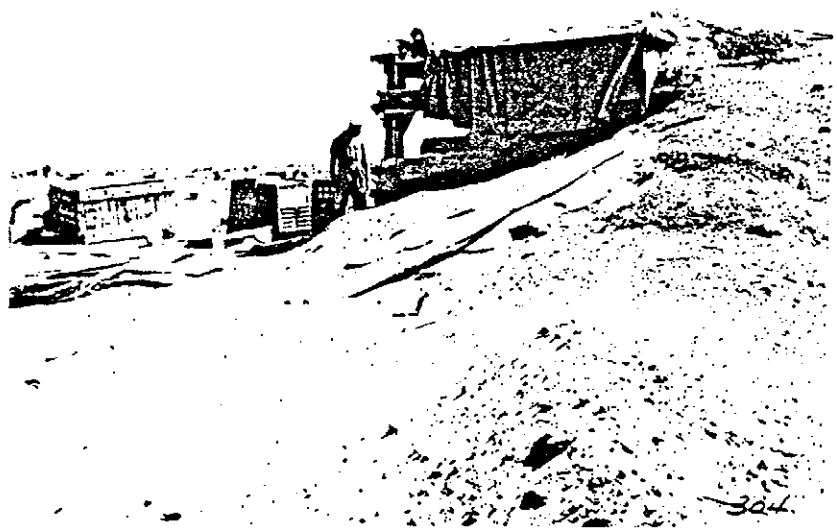
TR-228 1000 North
"1000 N after shot."



TR-286 1000 North
"1000 N apparatus after shot."

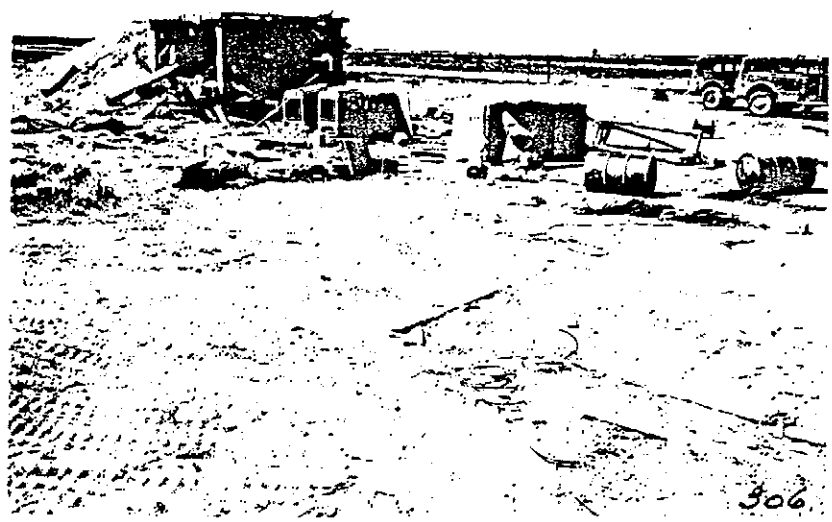


TR-301 1000 North
"1000 N after shot."

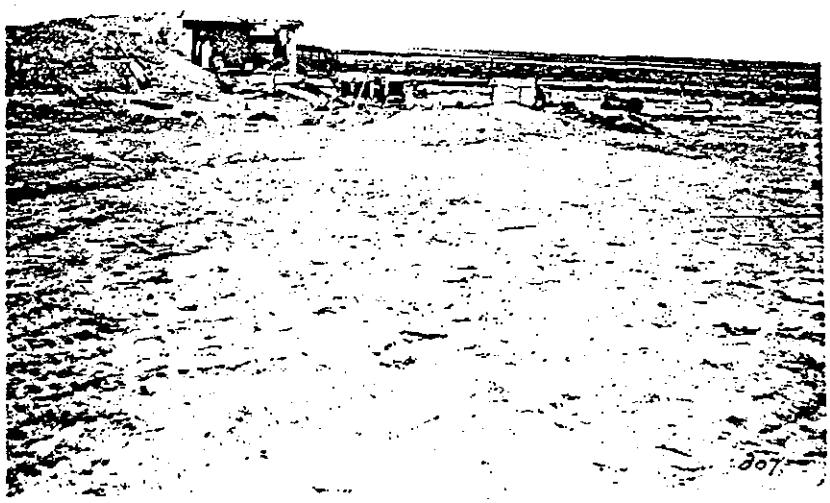


TR-304 1000 North
"1000 N after shot."

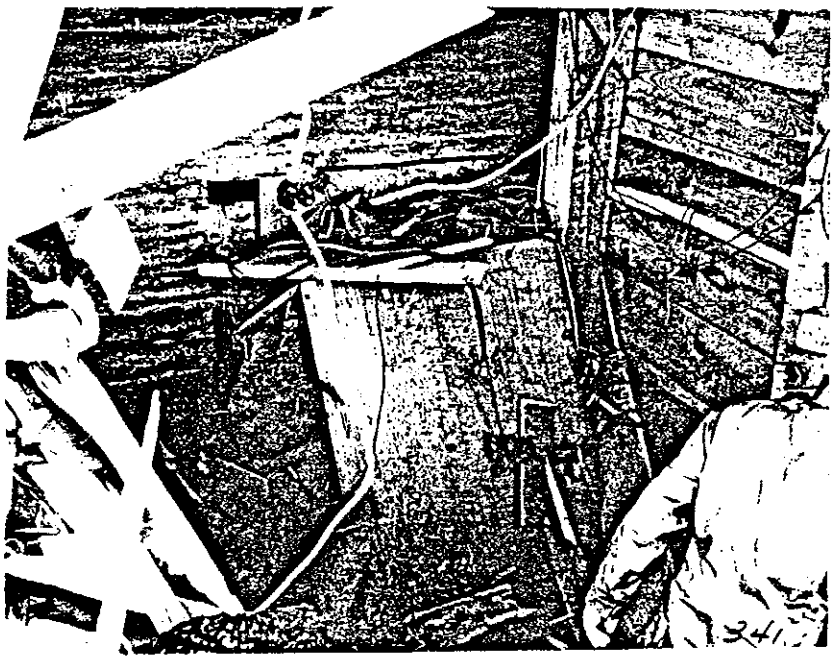
TR-305 1000 North
"Going in party at 1000 N."



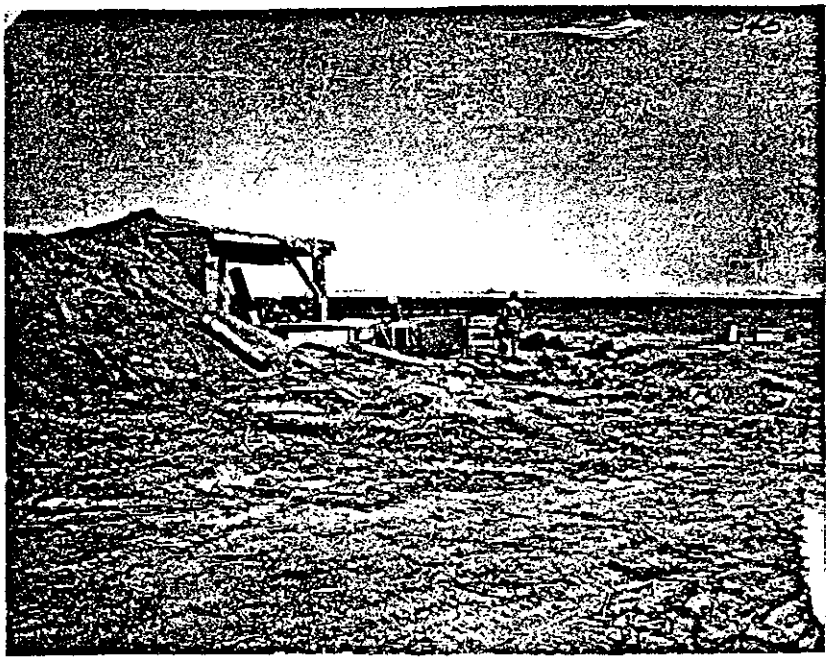
TR-306 1000 North
"1000 N after shot."



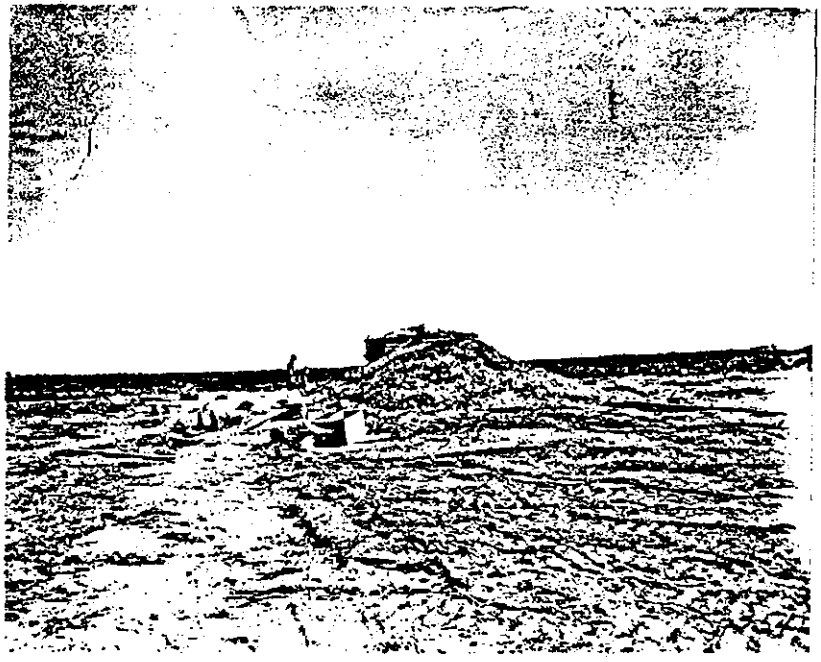
TR-307 1000 North
"1000 N after shot."



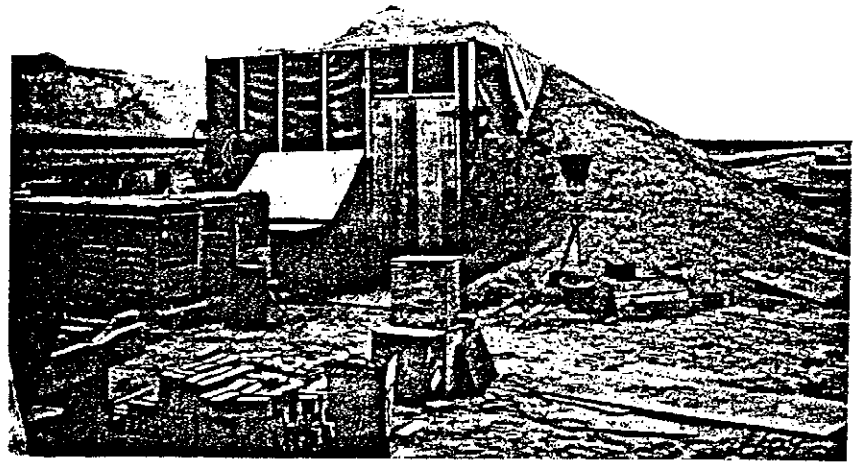
TR-341 1000 North
"Damage to equipment and shelter after A bomb blast July 16; perhaps this is the 1000 N shelter."



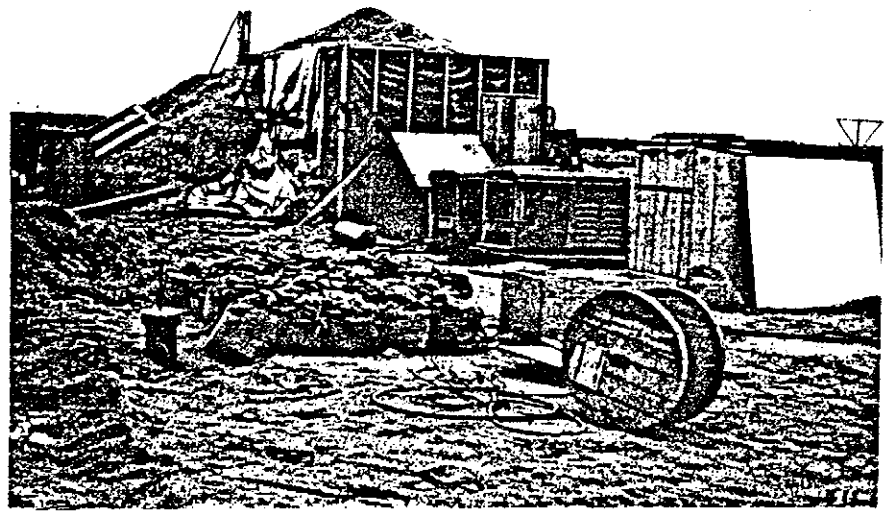
TR-345 1000 North
"Shelter at 1000 N, shows condition after shot."



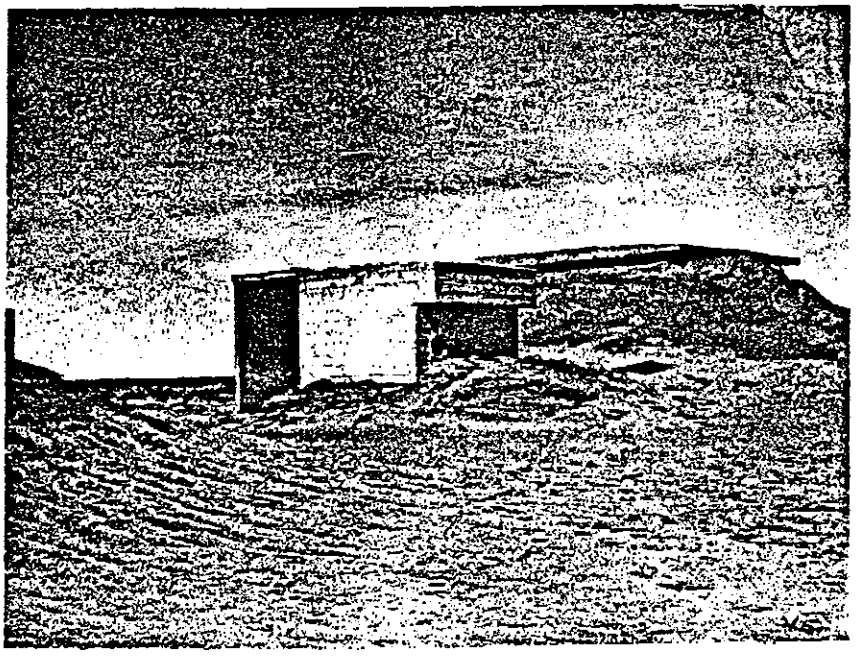
TR-354 1000 North
"Shows 1000 N station after July 16 explosion."



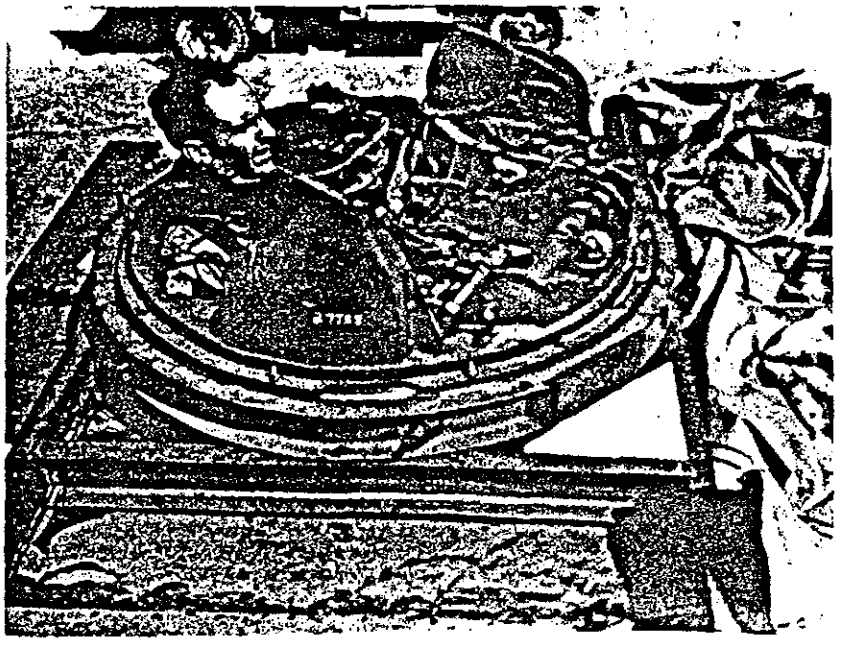
TR-409 1000 North
"1000 yards North before shot."



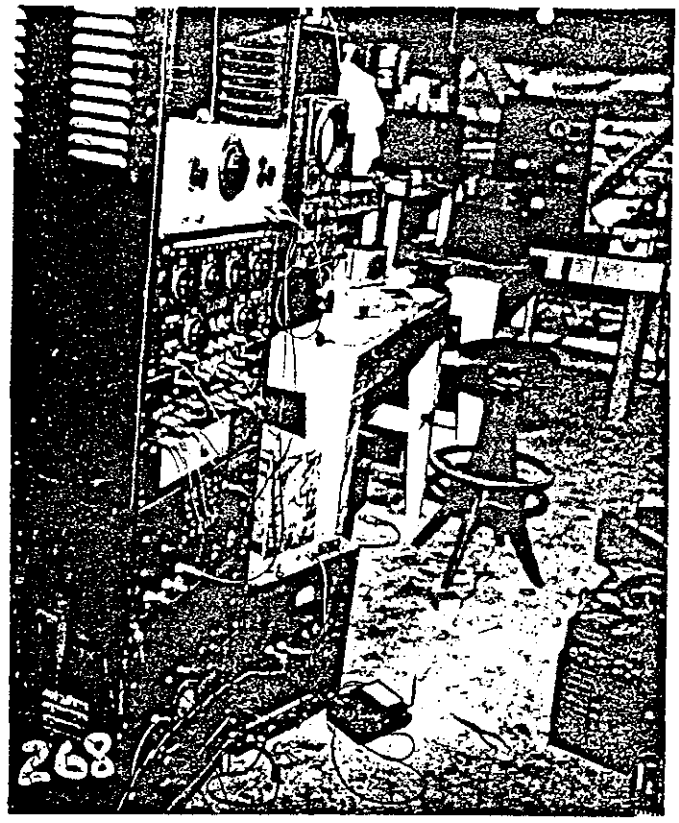
TR-411 1000 North
"1000 yards North before shot."



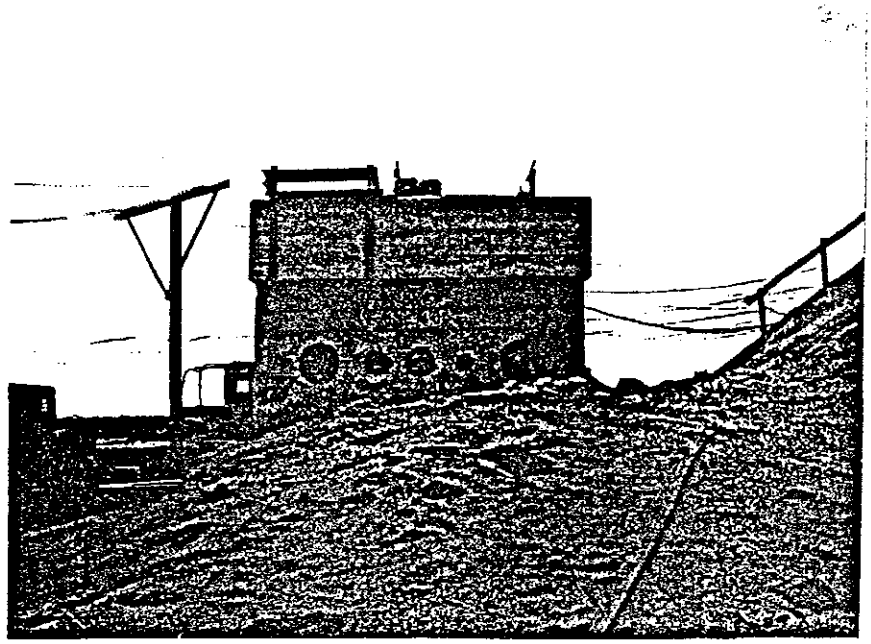
TR-45 10,000 North
"April 2, 1945. 10,000 yards N station, camera shelter in center of picture."



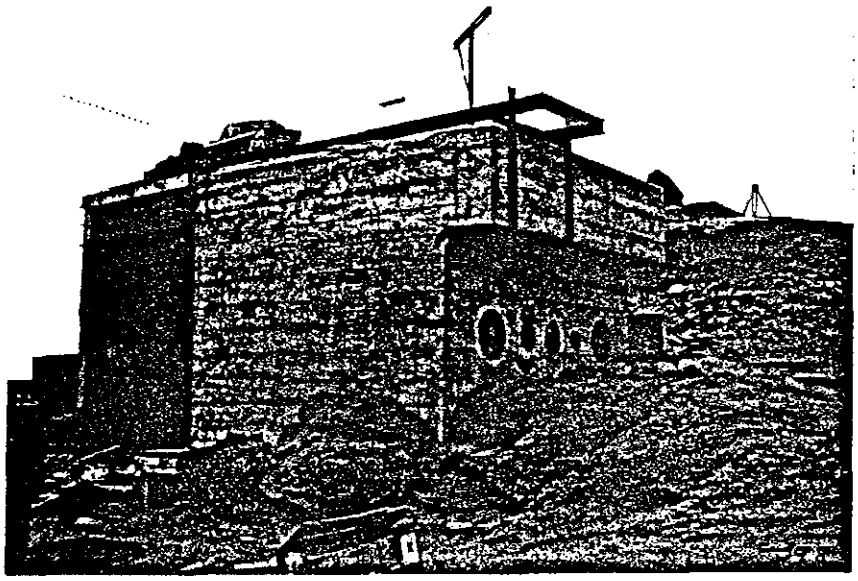
TR-201 10,000 North
"Turret for following camera. George Econnemu."



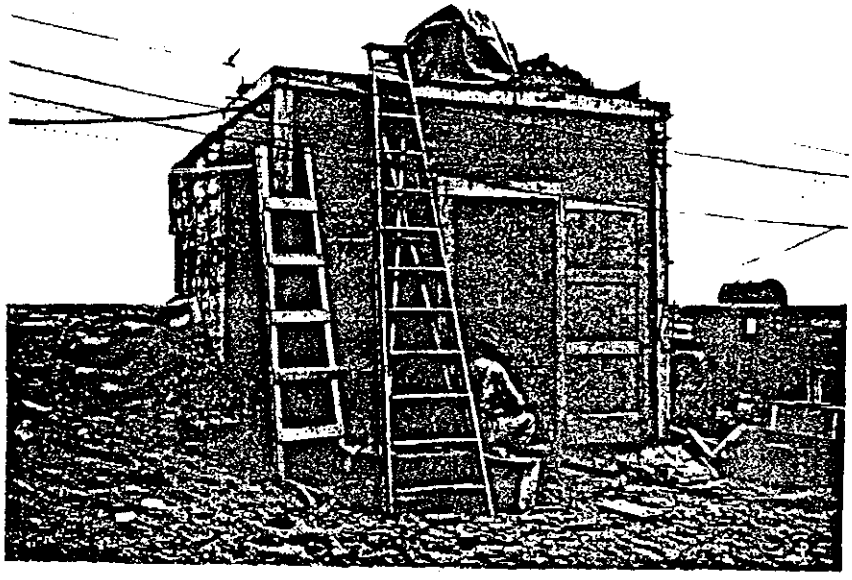
TR-268 10,000 North
"10,000 N shelter."



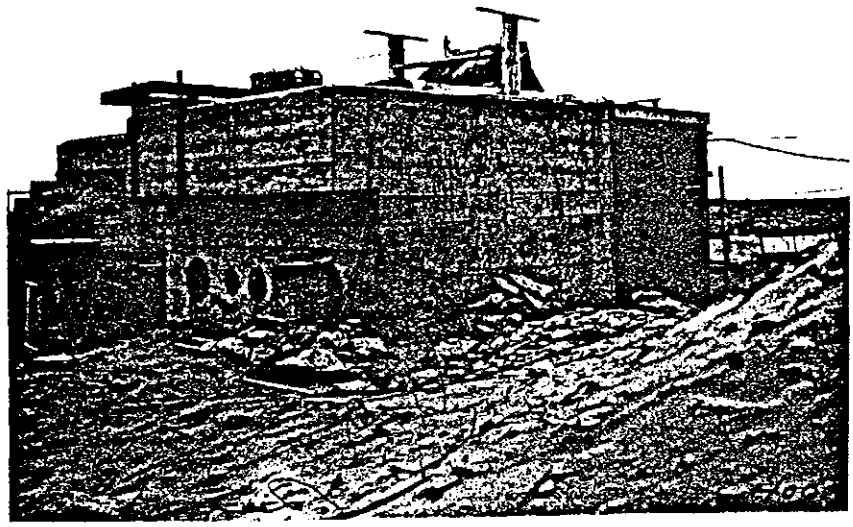
TR-397 10,000 North
"Photographic shelter at Point A."



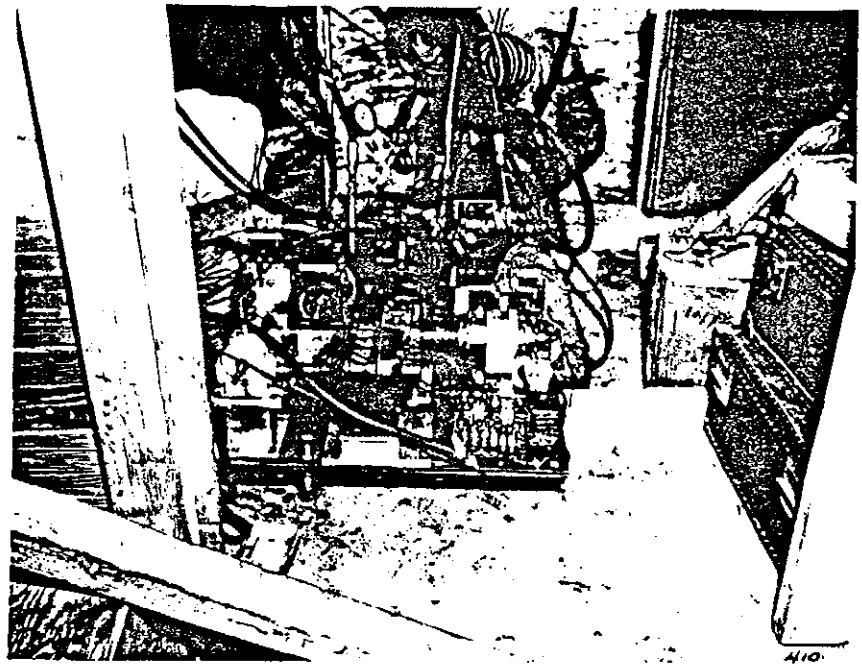
TR-398 10,000 North
"Camera installations, photo shelter."



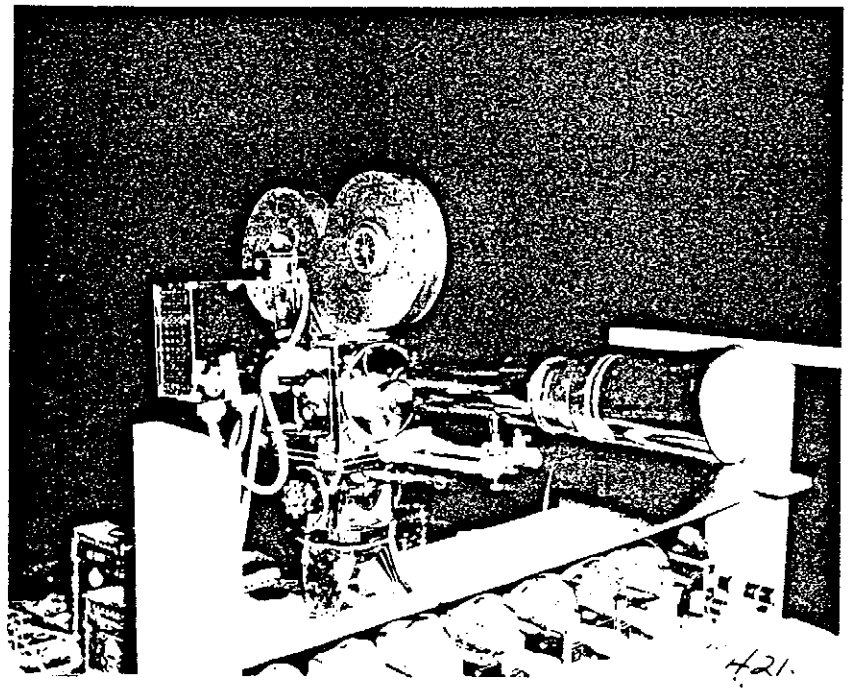
TR-399 10,000 North
"Photographic shelter at Point A."



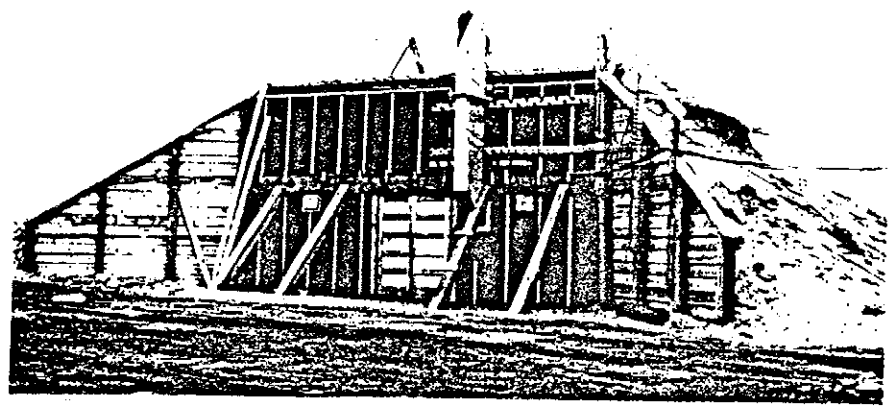
TR-400 10,000 North
"Photo shelter at Point A."



TR-410 10,000 North
"B & L spectrograph hydraulic mechanism."

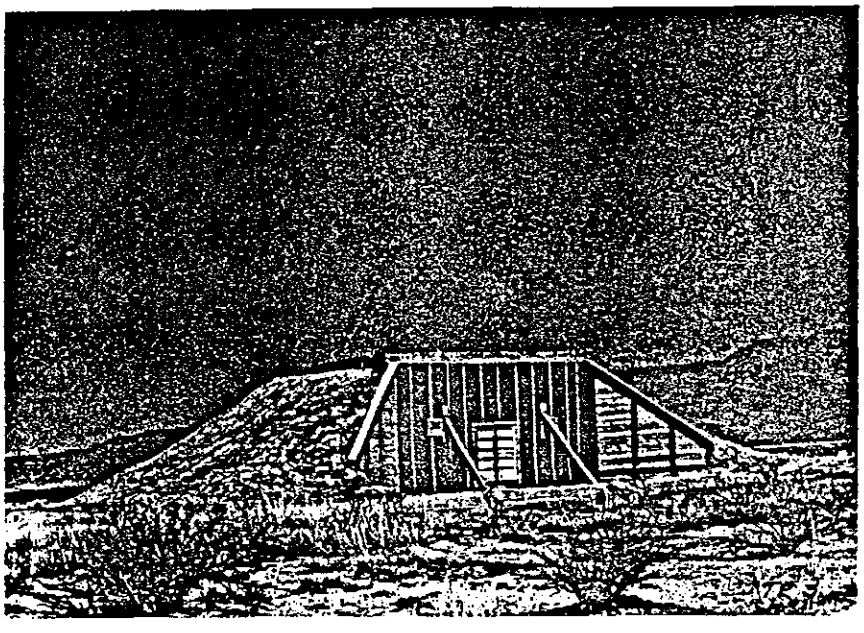


TR-421 10,000 North
"Mitchell 35 mm camera."

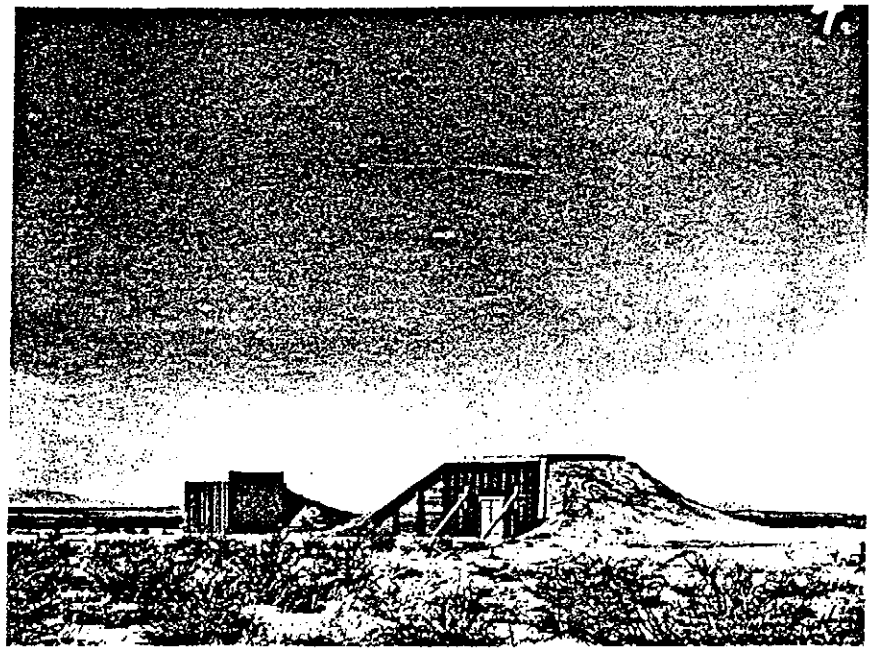


TR-425 10,000 North
"Personnel Shelter A."

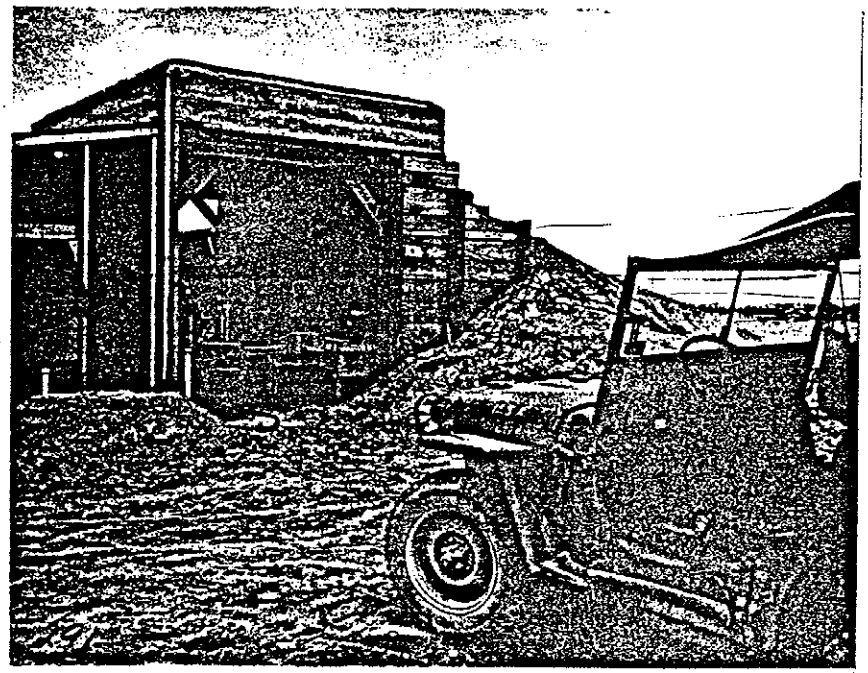
TR-779 10,000 North
"Station A. Shows hydraulic control mechanism for B and L spectrograph film."



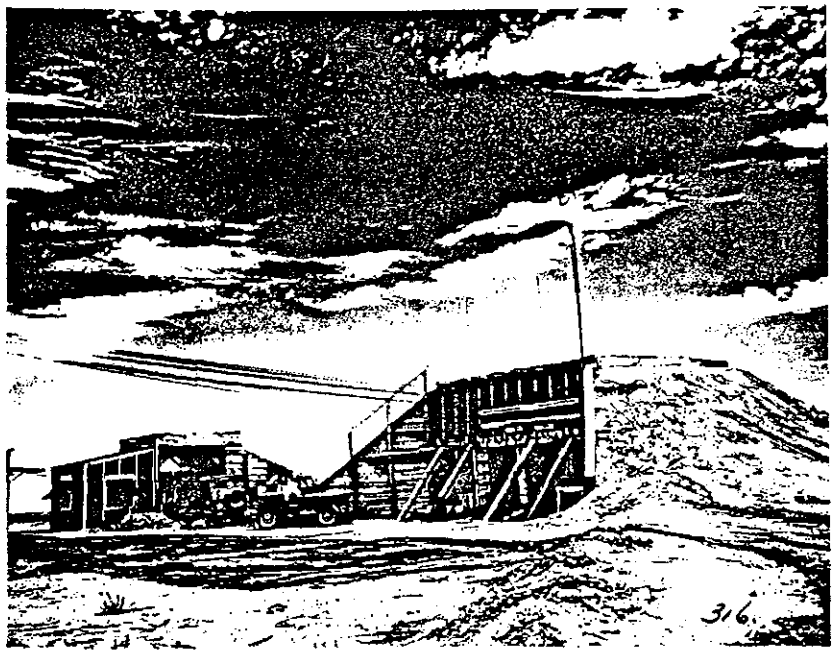
TR-3 10,000 South
"March 20, 1945. Site 'B', South 10,000 yards. Shows timing control shelter just after construction."



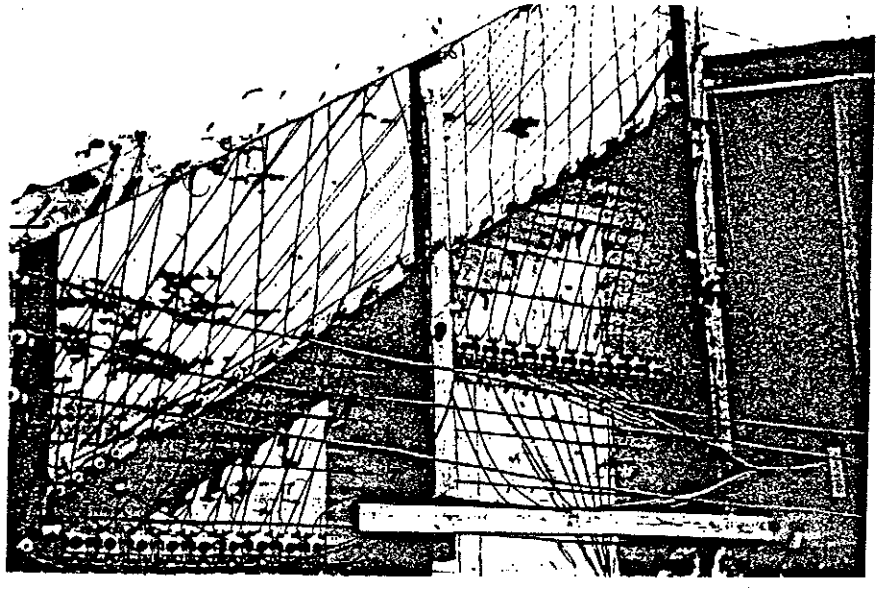
TR-4 10,000 South
"March 20, 1945. Site 'B' showing timing control shelter at right, power plant shelter at left."



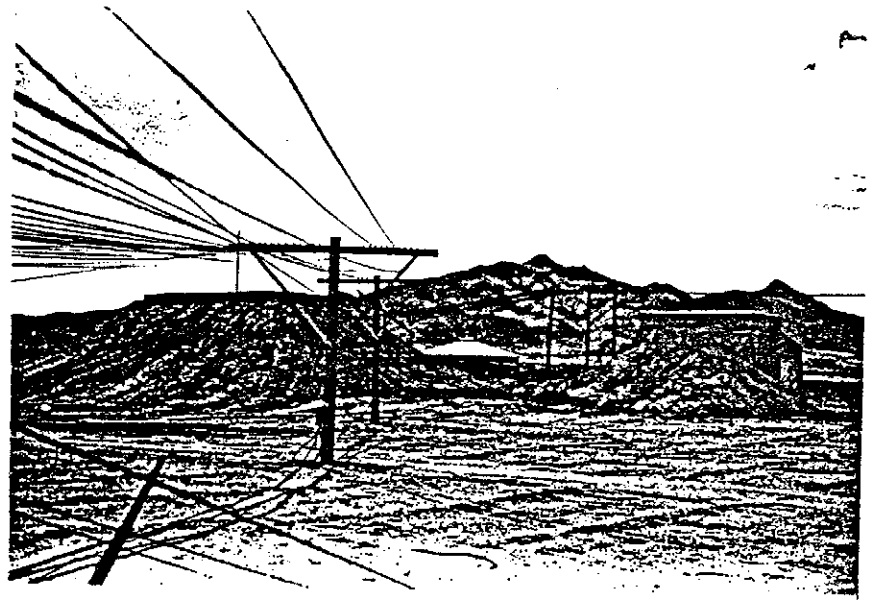
TR-291 10,000 South
"Generator at 10^4 S station."



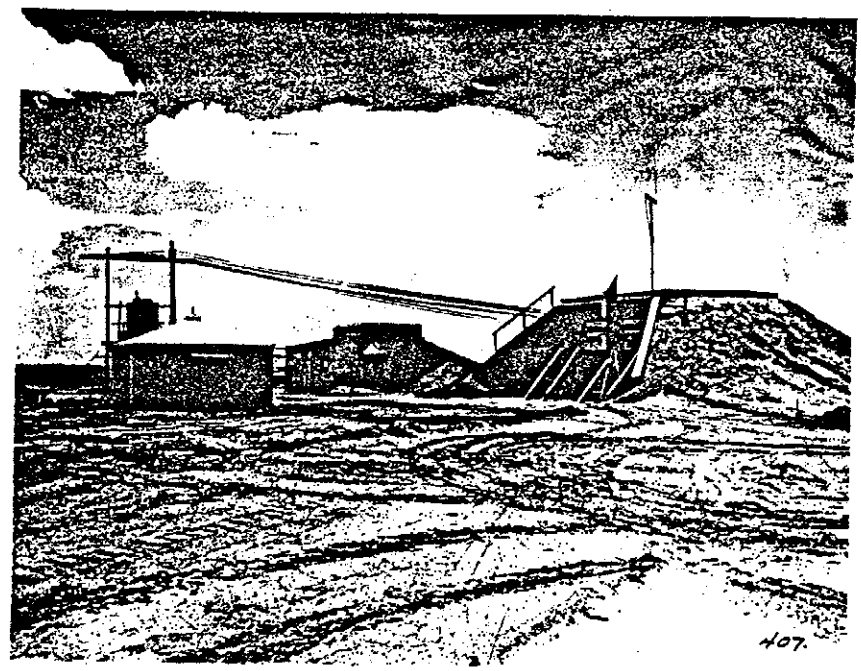
TR-316 10,000 South
"Station 10^4 South."



TR-369C 10,000 South
"Signal wires near point B."

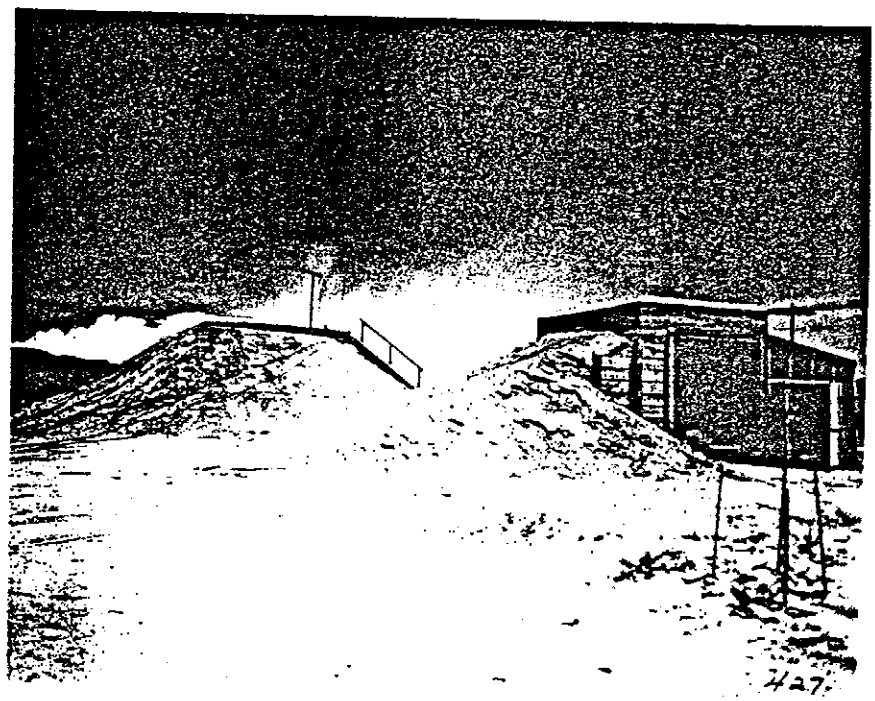


TR-370 10,000 South
"Point B taken from north."

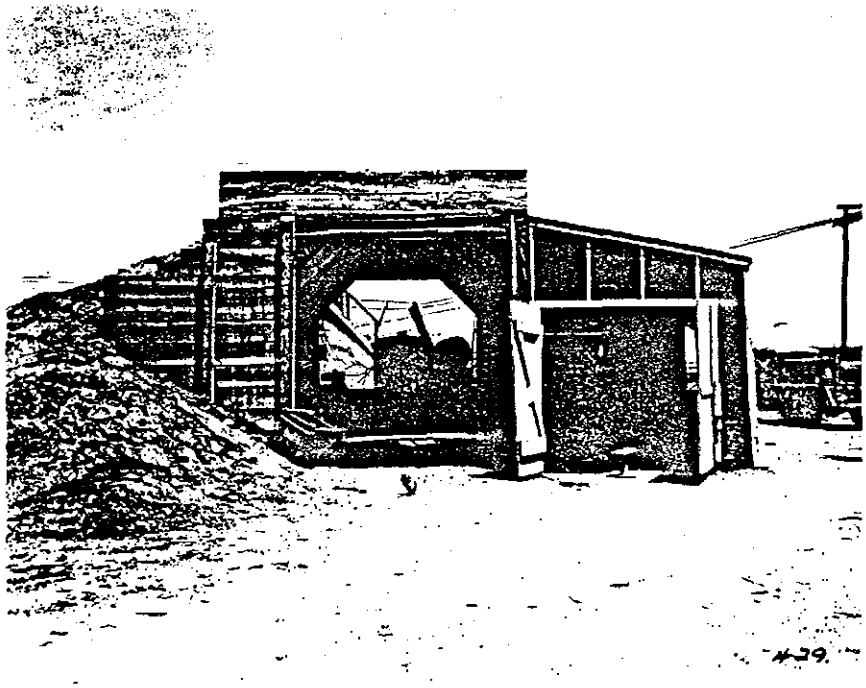


TR-407 10,000 South
"Point B."

TR-426 10,000 South
"Point B."



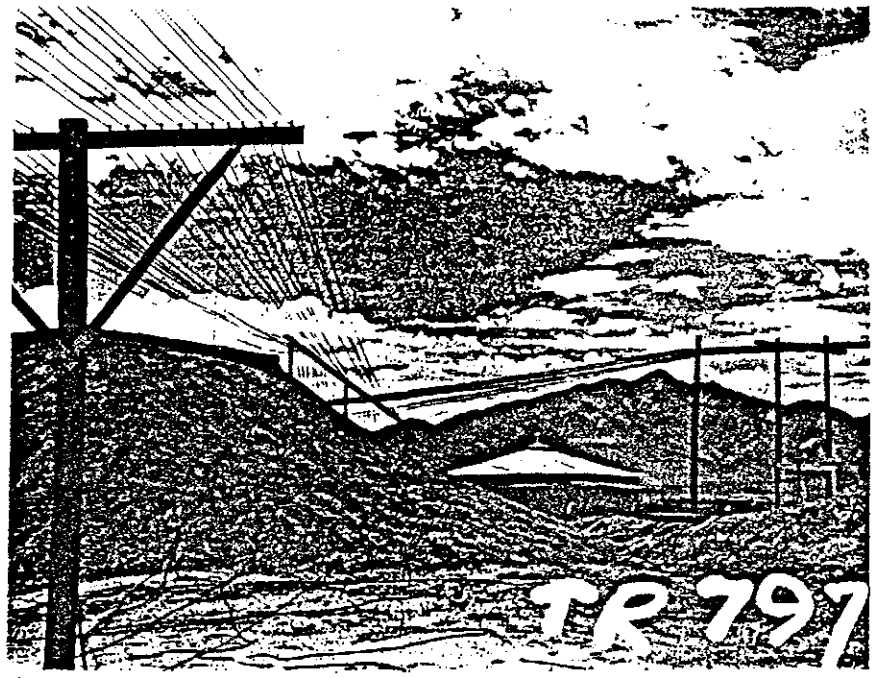
TR-427 10,000 South
"Point B."



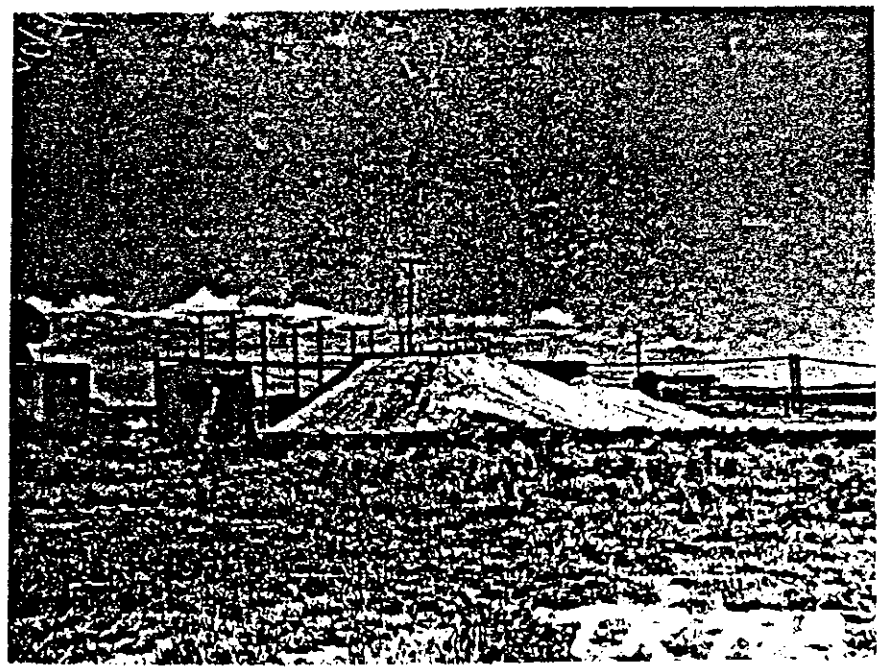
TR-429 10,000 South
"Power plant at B."

TR-771 10,000 South
"Shelter at Point B."

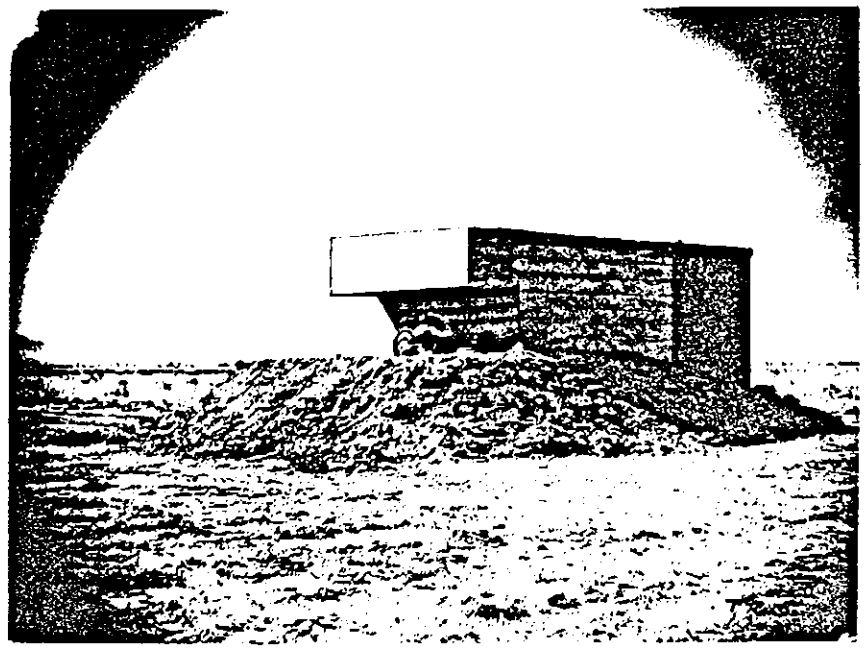
TR-778 10,000 South
"Point B, shelter at left is main central bunker, shelter at right houses power plant."



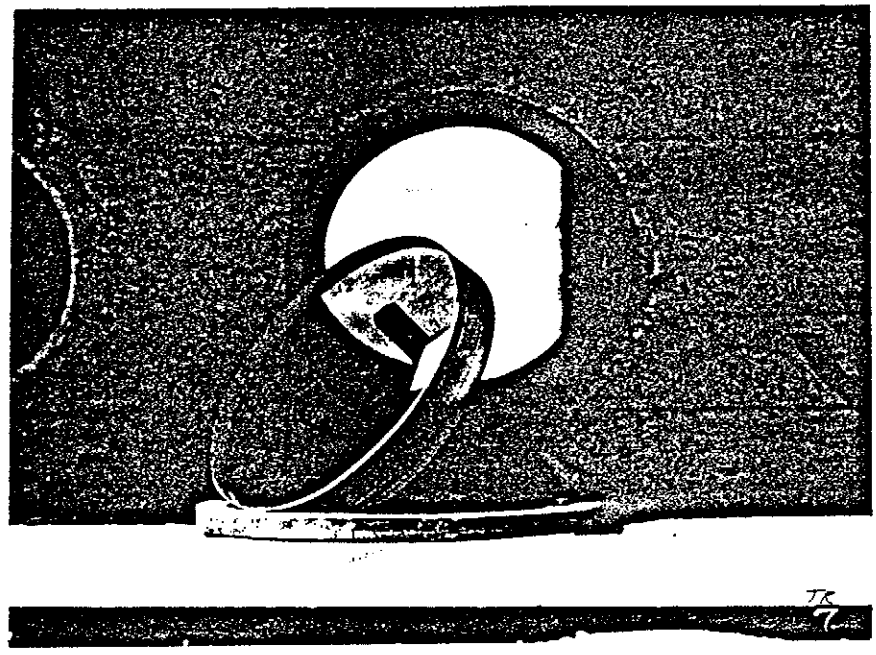
TR-797 10,000 South
"Station at 10,000 yards S."



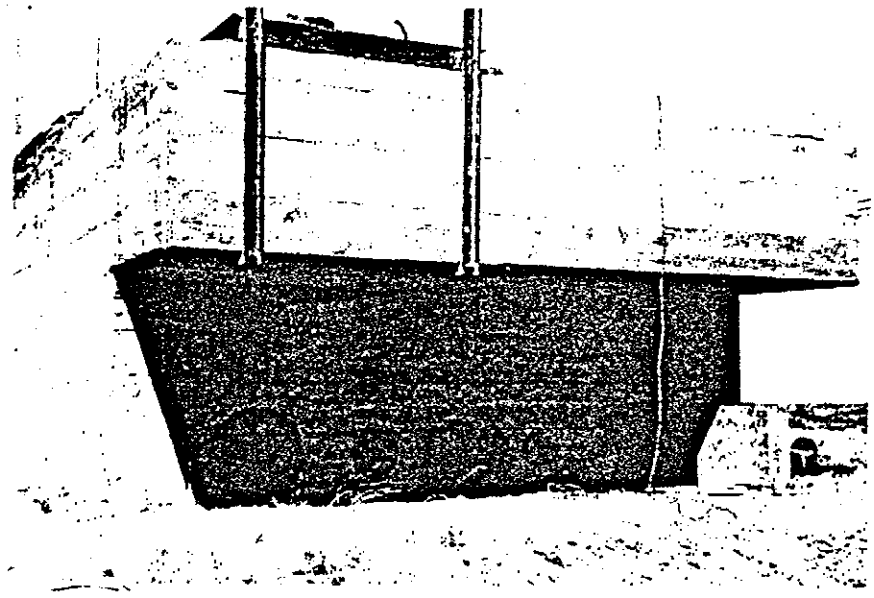
TR-798 10,000 South
"Station, 10,000 S showing radar antenna."



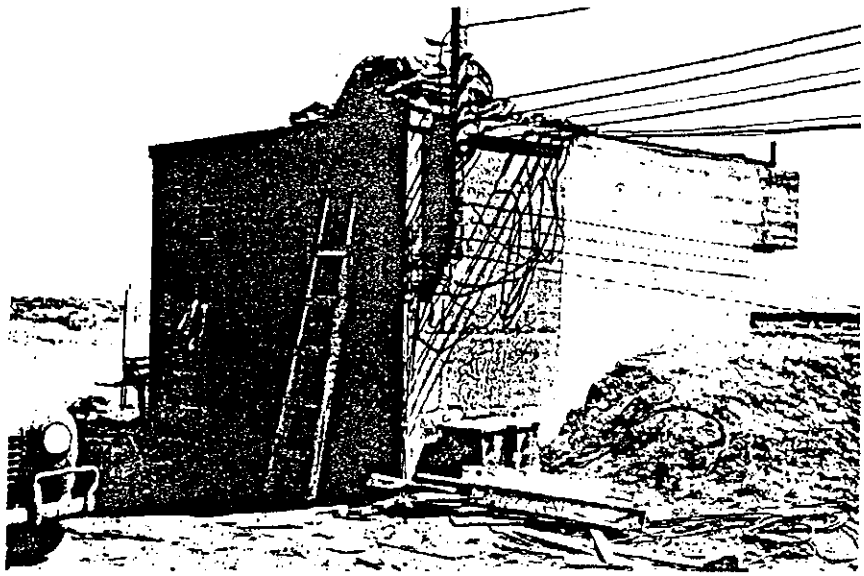
TR-5 10,000 West
"March 28, 1945. Site 'P', 10,000 yards West. Showing reinforced concrete camera shelter. B. C. Benjamin installing bulletproof windows in port holes."



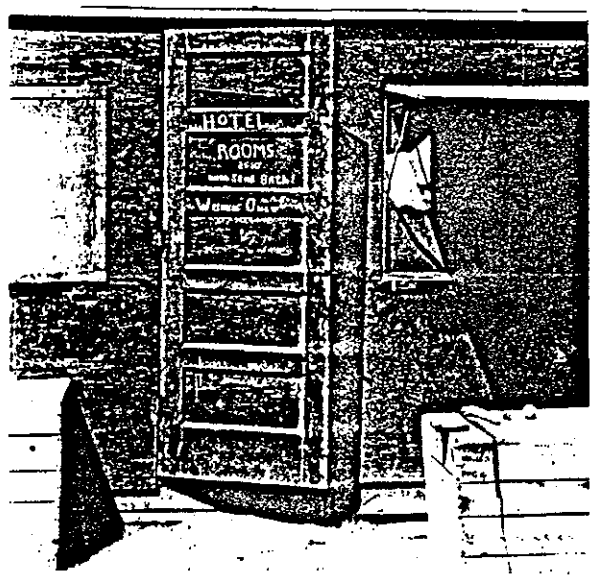
TR-7 10,000 West
"March 28, 1945. Site 'P' showing detail of port hole with bulletproof glass ready for installation."



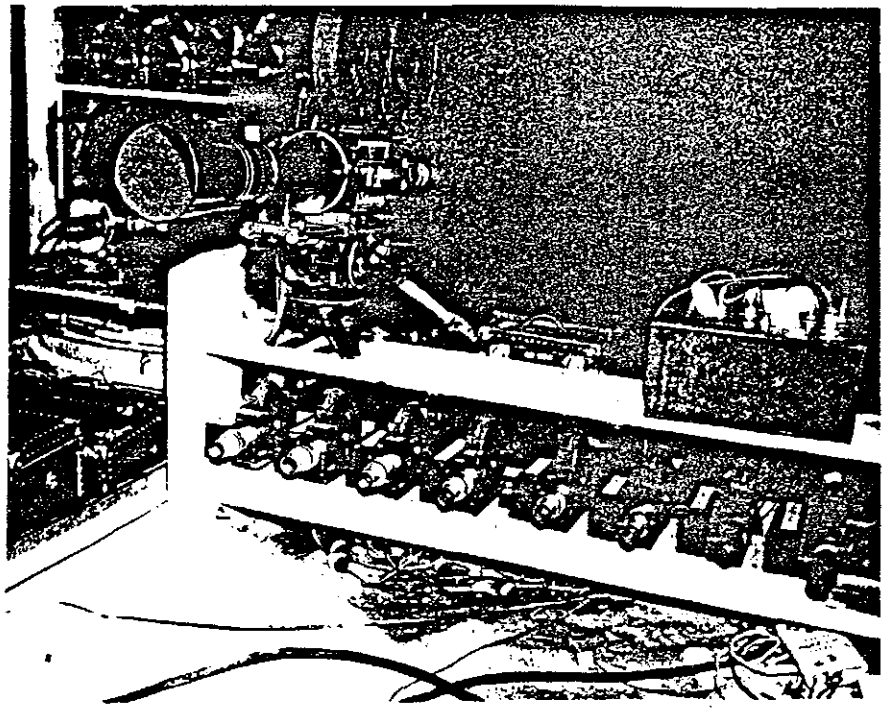
TR-396A 10,000 West
"Photographic shelter at point P."



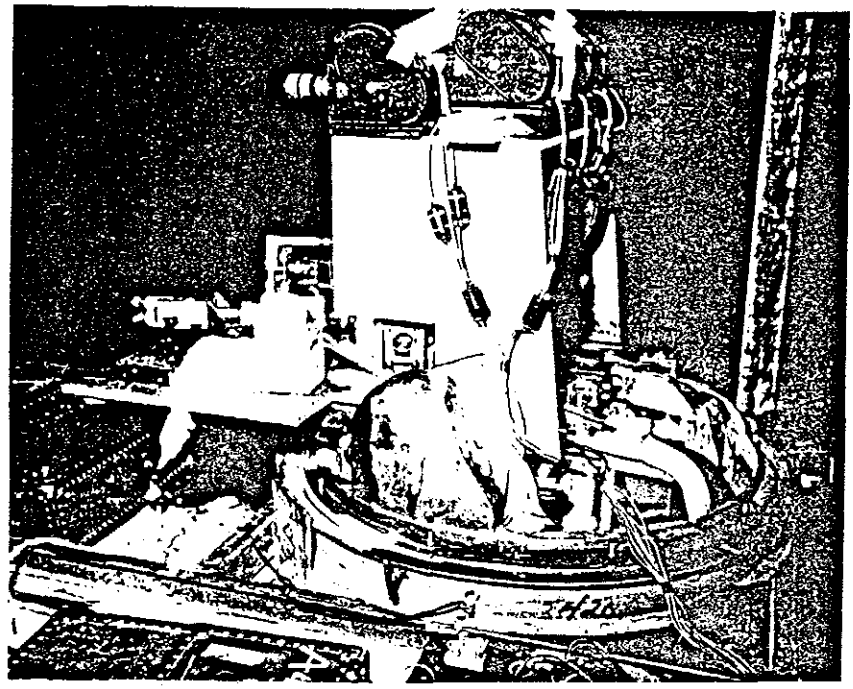
TR-396B 10,000 West
"Photographic shelter at point P."



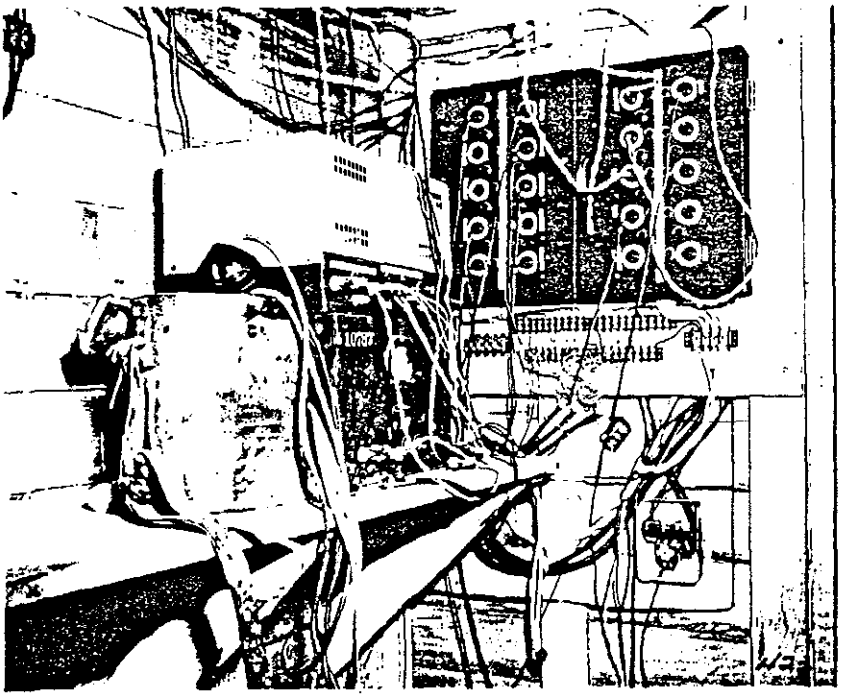
TR-396C 10,000 West
"Photographic shelter at point P." [Actually this is a nearby hutment]



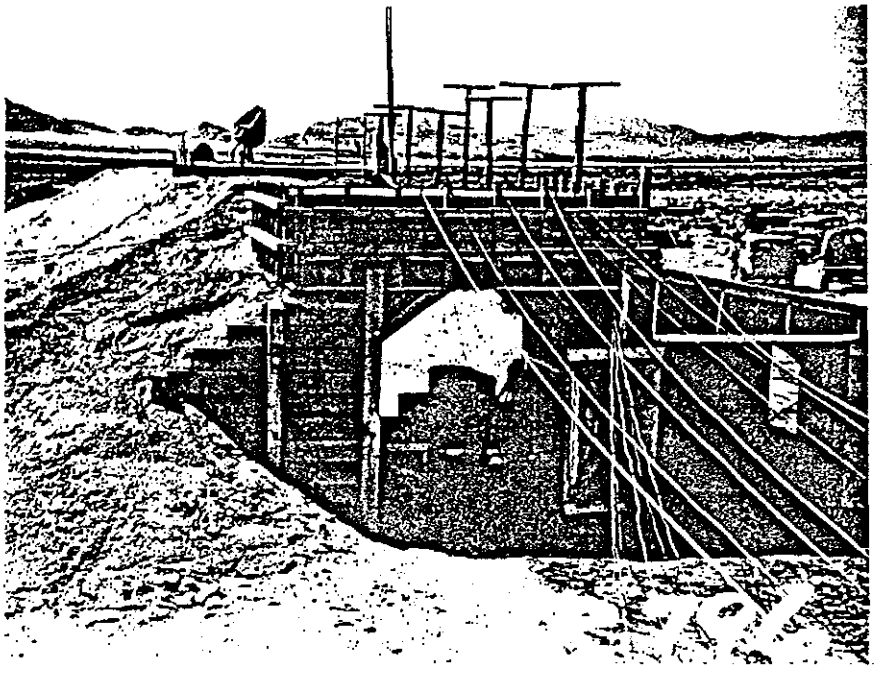
TR-419 10,000 West
"Battery of cameras at point P (top of shelter)."



TR-420 10,000 West
"Turret on photo shelter."



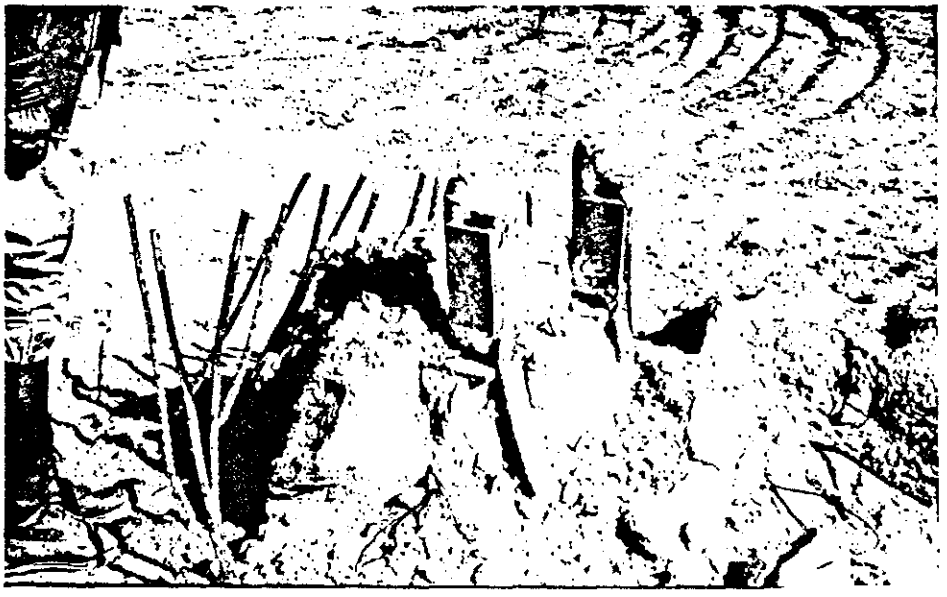
TR-423 10,000 West
"Inside photo shelter at point P."



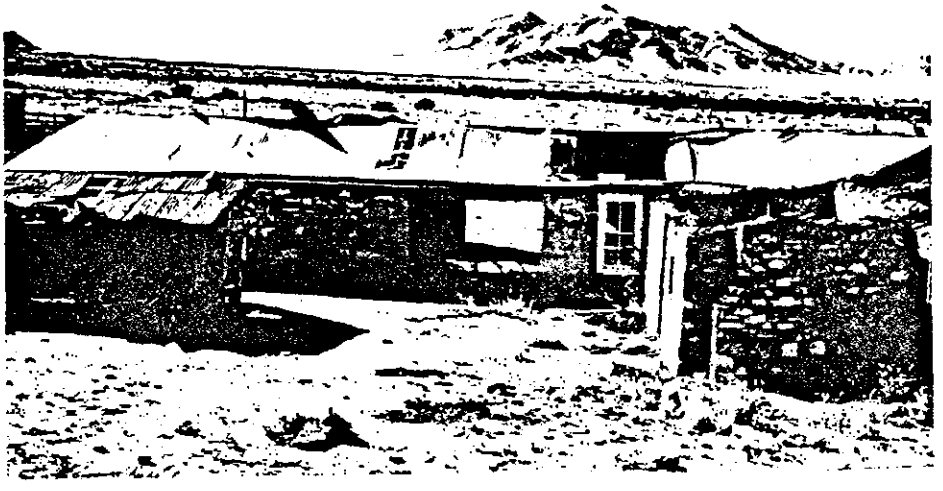
TR-796 10,000 West
"Power plant at 10,000 yards W."

TR-800 10,000 West
"Central station."

The following are copies of two slides taken at Trinity Site in 1945 and stored in the slide collection of the Historic American Buildings Survey/Historic American Engineering Record, National Park Service, Washington, D.C. Information printed on the slide is shown in quotes.



"Atomic Bomb Site, N.M. T37-6. Scoyen '45.
Present remains at Zero."



"Atomic Bomb Site, N.M. T37-3. Scoyen '45.
Sheds at McDonald Ranch, 3000 yards from Zero."